

R E P O R T R E S U M E S

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ELECTROMECHANICAL INSTALLATION AND REPAIR CLUSTER--AN INVESTIGATION AND DEVELOPMENT OF THE CLUSTER CONCEPT AS A PROGRAM IN VOCATIONAL EDUCATION AT THE SECONDARY SCHOOL LEVEL.

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THIS COURSE OUTLINE ON ELECTROMECHANICAL INSTALLATION AND REPAIR IS PART OF THE FINAL REPORT ON "CLUSTER CONCEPT" COURSES IN VOCATIONAL EDUCATION FOR SECONDARY EDUCATION (ED 010 301). EACH JOB ENTRY TASK WAS ANALYZED FOR HUMAN REQUIREMENTS (COMMUNICATION, MEASUREMENT, MATHEMATICS, SCIENCE, SKILLS, AND INFORMATION) NECESSARY TO PERFORMANCE OF THE TASK. THE TASK STATEMENTS FOR SERVICING OF AIR CONDITIONING AND REFRIGERATION, BUSINESS MACHINES, HOME APPLIANCES, AND RADIO AND TELEVISION WERE WRITTEN IN BEHAVIORAL TERMS WHICH PROVIDE THE INSTRUCTOR WITH A DESCRIPTION OF WHAT THE STUDENT SHOULD BE ABLE TO DO AFTER HE HAS HAD THE LEARNING EXPERIENCE. INSTRUCTIONAL SEQUENCES WERE PROVIDED AT THE END OF THE TASK ANALYSIS SECTION TO AID THE TEACHER IN DEVELOPING LESSON PLANS, MATERIALS OF INSTRUCTION, AND VISUAL AIDS. (FOR OTHER COURSE OUTLINES SEE ED 010 302 AND ED 010 304.) (GC)

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**FINAL REPORT  
(One of Four Volumes)**

**AN INVESTIGATION AND DEVELOPMENT OF THE  
CLUSTER CONCEPT AS A PROGRAM IN VOCATIONAL  
EDUCATION AT THE SECONDARY SCHOOL LEVEL**

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**U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE  
Office of Education**

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## INTRODUCTION

The volume for the occupational cluster of Electro-Mechanical Installation and Repair is the result of the research procedures which are described in Part III of the final report volume. The research initially involved the identification of tasks which are required for entry into the occupations found in the Electro-Mechanical Installation and Repair Cluster. These tasks are classified into two categories:

**Level I** - Those tasks which are needed immediately upon job entry.

**Level II** - Those tasks which are not needed immediately for job entry into an occupation, but will be needed soon after entering the occupation.

Each job entry task was then analyzed with respect to the areas of human requirement (communication, measurement, mathematics, science, skills and information) which are necessary for the performance of the task. The task statements and the areas of human requirement are written in behavioral terms which provide the instructor with a description of what the student should be able to do after he has had the learning experience.

The areas of human requirement that are common to the occupations included in the Electro-Mechanical Installation and Repair Cluster have been determined and are identified in the task analysis section in the following manner:

**A** Common to all occupations

**\*** Common to more than one occupation

**◊** Common within the occupation

**A suggested instructional sequence for each task is provided**

for the teacher at the end of the task analysis section. The task is shown at the top of the page with the headings for the areas of human requirement listed below the task. Under each heading the behavioral statements have been arranged in a suggested instructional sequence. The arrangement provides the teacher with an instructional pattern that can also be used to develop lesson plans, materials of instruction and visual aids.

A course outline has been developed for each occupation in the Electro-Mechanical Installation and Repair Cluster. The outlines are based upon an analysis of the job entry tasks and the identification of common areas of human requirement.

## **JOB ENTRY TASKS**

### **ELECTRO-MECHANICAL INSTALLATION AND REPAIR**

A list of tasks have been identified in this section of the report that are needed for entry into the occupations included in the electro-mechanical installation and repair cluster. The job entry tasks for the cluster are classified into two categories:

**Level I** - those tasks which are needed immediately upon job entry.

**Level II** - those tasks which are not needed immediately for job entry into an occupation, but will be needed soon after entering the occupation.

## LEVEL I JOB ENTRY TASKS

### Air Conditioning & Refrigeration Servicing

#### Task No.

#### Task Statements

2. Testing lines with detection device for leaks
4. Evacuating the entire system with a vacuum pump to remove all non-condensables.
5. Removing the cover from the unit for ease of servicing.
7. Replacing the cover on the unit to restore to the original condition.

### Business Machine Servicing

2. Disassembling the typewriter for cleaning.
3. Cleaning typewriter to remove dirt.
7. Removing the defective part(s) of the typewriter.
12. Cleaning the calculator to remove dirt.
17. Disassembling the adding machine for cleaning.
18. Cleaning the adding machine to remove dirt.

### Home Appliance Servicing

1. Observing the symptoms to determine the defect(s) in small heating element appliances.
2. Disassembling small heating element appliances for testing and repairing.
3. Isolating the defect to a particular section of the heating element appliance.
4. Isolating the defect to a particular component of the heating element appliance.
5. Replacing the defective part(s) of small heating element appliances.
6. Testing the operations of the repaired small heating element appliance.

7. Reassembling the repaired small heating element appliance.
8. Retesting the assembled small heating element appliance.
9. Observing the symptoms to determine the defect(s) in small motor driven appliances.
10. Disassembling small electric motor appliances for testing and repairing.
11. Isolating the mechanical defects to a particular section of the small electric motor appliances.
12. Isolating the electrical defect(s) to a particular section of the small electric motor appliances.
13. Isolating the defect to a particular component of the small electric motor appliance.
14. Replacing the defective part(s) of the small electric motor appliances.
15. Testing the operation of the repaired small electric motor appliances.
16. Reassembling the repaired small electric motor appliance.
17. Retesting the repaired small electric motor appliances.
18. Connecting the electrical supply to the electric range in the home.
19. Checking the installation of the electric range and making any final adjustments necessary.
20. Explaining the operation of the electric range to the customer.
21. Installing the vent system for the automatic dryer in the home.
22. Connecting the electrical supply to the automatic dryer in the home.
23. Testing the installation of the automatic dryer and making any final adjustments necessary.
24. Explaining the operation of the automatic dryer to the customer.
25. Connecting the water supply to the automatic washer in the home.

26. Connecting the electrical supply to the automatic washer in the home.
27. Checking the installation of the automatic washer and making any final adjustments necessary.
28. Explaining the operation of the automatic washer to the customer.
29. Connecting the electrical supply to the refrigerator in the home.
30. Checking the installation of the refrigerator and making any final adjustments necessary.
31. Explaining the operation of the refrigerator to the customer.
32. Observing the symptoms to determine the defect(s) in an automatic washer.
33. Disassembling the automatic washer in order to make the necessary repair(s).
37. Replacing the defective part(s) of the automatic washer.
42. Retesting the assembled automatic washer.
46. Disassembling the automatic electric dryer in order to make the necessary repair(s).
48. Replacing the defective part(s) of the automatic electric dryer.
51. Testing the operation of the automatic electric dryer.
52. Making any final adjustments to the repaired automatic electric dryer.
53. Retesting the assembled automatic electric dryer.
55. Disassembling the refrigerator in order to make the necessary repair(s).
59. Replacing the defective part(s) of the refrigerator.
62. Testing the operation of the refrigerator.
63. Making any final adjustments to the repaired refrigerator.
64. Retesting the assembled refrigerator.
67. Disassembling the electric range in order to make the necessary repair(s).

70. Replacing the defective part(s) of the electric range.
72. Reassembling the repaired electric range.
73. Testing the operation of the electric range.
74. Making any final adjustments to the repaired electric range.
75. Retesting the assembled electric range.

#### **Radio and Television Servicing**

1. Observing the symptoms to determine the defective stage of the radio.
2. Checking the tubes in the suspected defective stage of the radio.
3. Removing the chassis from the cabinet for ease of servicing.
5. Replacing the defective components in a particular stage of the radio.
6. Replacing the chassis in the cabinet after a final inspection of the radio.
7. Making final operational checks and adjustment to the radio.
8. Observing the symptoms to determine the defective stage of the television set.
9. Checking the tubes in the suspected stage.
10. Removing the chassis from the cabinet for ease of servicing.
12. Replacing the defective components in a particular stage of the television set.
13. Replacing the chassis in the cabinet after a final inspection of the television set.
14. Making final operational checks and adjustment to the television set.

**LEVEL II JOB ENTRY TASKS****Air Conditioning & Refrigeration Servicing****Task  
No.****Task Statements**

1. Installing tubing between case and condensing unit.
3. Installing gages on condensing unit to charge the unit with refrigerant.
6. Replacing the defective components in the refrigeration unit.

**Business Machine Servicing**

1. Observing the symptoms to determine the defects in a typewriter.
4. Isolating the mechanical defects to a particular section of the typewriter.
5. Isolating the electrical defect(s) to a particular component of the typewriter.
6. Isolating the mechanical defect(s) to a particular component of the typewriter.
8. Replacing the defective part(s) of the typewriter.
9. Reassembling the repaired typewriter.
10. Testing the operation of the repaired typewriter.
11. Disassembling the calculator for cleaning.
13. Removing the defective part(s) of the calculator.
14. Replacing the defective part(s) of the calculator.
15. Reassembling the repaired calculator.
16. Testing the operation of the repaired calculator.
19. Removing the defective part(s) of the adding machine.
20. Replacing the defective part(s) of the adding machine.
21. Reassembling the repaired adding machine.
22. Testing the operation of the repaired adding machine.

## Home Appliance Servicing

34. Isolating the electrical defect(s) to a particular section of the automatic washer.
35. Isolating the mechanical defect(s) to a particular section of the automatic washer.
36. Isolating the defect(s) to a particular component in an automatic washer.
38. Repairing the defective part(s) of the automatic washer.
39. Reassembling the repaired automatic washer.
40. Testing the operation of the automatic washer.
41. Making any final adjustments to the repaired automatic washer.
43. Observing the symptoms to determine the defect(s) in an automatic electric dryer.
44. Isolating the electrical defect(s) to a particular section of the automatic electric dryer.
45. Isolating the mechanical defect(s) to a particular section of the automatic electric dryer.
47. Isolating the defect(s) to a particular component in an automatic electric dryer.
49. Repairing the defective part(s) of the automatic electric dryer.
50. Reassembling the repaired automatic electric dryer.
54. Observing the symptoms to determine the defect(s) in a refrigerator.
56. Isolating the electrical defect(s) to a particular section of the refrigerator.
57. Isolating the mechanical defect(s) to a particular section of the refrigerator.
58. Isolating the defect(s) to a particular component in a refrigerator.
60. Repairing the defective part(s) of the refrigerator.
61. Reassembling the repaired refrigerator.

65. Observing the symptoms to determine the defect(s) in an electric range.
66. Isolating the electrical defect(s) to a particular section of the electric range.
68. Isolating the mechanical defect(s) to a particular section of the electric range.
69. Isolating the defect(s) to a particular component in an electric range.
71. Repairing the defective part(s) of the electric range.

#### **Radio and Television Servicing**

4. Isolating the defective components in a particular stage of the radio.
11. Isolating the defective components in a particular stage of the television set.
15. Installing an outdoor television antenna and transmission line.

## **TASK ANALYSIS**

### **ELECTRO-MECHANICAL INSTALLATION AND REPAIR**

This section of the report identifies the results of an analysis of the job entry tasks with respect to the areas of human requirement (communication, measurement, mathematics, science, skills, and information) needed for the performance of the tasks. The task statements and the areas of human requirement are written in behavioral terms which provide the instructor with a description of what the student should be able to do after he has had the learning experience. The areas of human requirement that are common to the occupations in the cluster have been determined and are identified in the following manner:

**Δ Common to all occupations.**

**\* Common to more than one occupation.**

**Ø Common within the occupation.**

## **TASK 1: INSTALLING TUBING BETWEEN CASE AND CONDENSING UNIT**

### **COMMUNICATION**

- 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks:**
  - a. Installation procedures and techniques**
  - b. Service procedures**
  - c. Type, function and rating of defective part**
  - d. Electrical supplies**
  - e. Repair and replacement of components**
  - f. Special service tools**
  - g. Electrical codes**
- \* 2. Interpreting instructions and information located on the data plate of the unit.**

### **MEASUREMENT**

- 1. Measuring the inside diameter and outside diameter of tubing with calipers and rule.**
- \* 2. Measuring the length of tubing with steel tape to accuracy of 1/16 of an inch.**

### **MATHEMATICS**

- 1. Adding numbers and fractions to determine total length of tubing.**

### **SCIENCE**

- 1. Explaining the physical properties of copper when being worked or exposed to the elements.**

### **SKILLS**

- 1. Bending tubing with a machine and spring to fit the unit.**
- 2. Cleaning tubing with abrasive cloth for soldering to remove corrosion.**
- 3. Cutting tubing to specific lengths with tubing cutter.**
- 4. Reaming tubing to remove the inside burr with hand reamer.**
- 5. Flaring tubing with a flaring tool to insure proper seal.**

**6. Soldering tubing with soft or silver solder with a torch.**

**INFORMATION**

1. Explaining how to make allowances for bends.
2. Apply the proper care, maintenance and storage of tube cutters.
- \* 3. Selecting the proper types of fluxes and solders for their respective uses.
- \* 4. Selecting the proper type & size of reamer for the job to be done.
- \* 5. Practicing safety precautions when soldering.

**TASK 2: TESTING LINES WITH DETECTION DEVICE FOR LEAKS**

**COMMUNICATION**

1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting instructions and information located on the data plate of the unit.

**SCIENCE**

1. Explaining the chemistry of refrigerants and their reaction in contact with other materials.

**SKILLS**

1. Regulating the pressure on a halide leak detector.
- \* 2. Applying the proper procedures when using halide leak detector.
3. Applying the proper procedures when using an electronic leak detector.

4. Applying the proper procedures when checking for refrigerant leaks when using:

- a. Soap test
- b. Litmus paper
- c. Sulphur stick

#### INFORMATION

- \* 1. Recognizing the different types of refrigerants.
- 2. Demonstrating proper safety precautions when testing for refrigerant leaks in enclosed spaces.
- \* 3. Practicing safety procedures when handling refrigerants.
- 4. Selecting the proper type of refrigerant according to specifications.

#### **TASK 3: INSTALLING GAGES ON CONDENSER TO CHARGE THE UNIT WITH REFRIGERANT**

#### COMMUNICATION

- 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting instructions and information located on the data plate of the unit.
- \* 3. Interpreting gauges to determine the depth and duration of vacuum as indicated in specifications.

#### MATHEMATICS

- 1. Converting gage pressure to absolute, inches or millimeters of mercury.

#### SKILLS

- 1. Demonstrating the proper procedures when connecting a service gauge manifold when charging refrigerator system.

#### INFORMATION

- 1. Recognizing the various types of gauges.

2. Recognizing types and use of manometers.
3. Recognizing types and use of wet wick vacuum indicators.
4. Recognizing necessary care when using vacuum indicators.
5. Recognizing the results of excessive pressures in the refrigerator system.
6. Applying the proper care, maintenance and storage of instruments.

**TASK 4: EVACUATING ENTIRE SYSTEM WITH VACUUM PUMP TO REMOVE ALL NON-CONDENSIBLES**

**COMMUNICATION**

1. Reading instruments (gauges) to determine desired vacuum.
- \* 2. Interpreting gauges to determine the depth and duration of vacuum as indicated in specifications.

**MEASUREMENT**

- \* 1. Measuring refrigerant in system with a pressure gauge.

**MATHEMATICS**

1. Converting inches of vacuum to per cent of air.

**SCIENCE**

1. Explaining the process of changing a liquid to a gas.

**SKILLS**

1. Demonstrating the procedure of using vacuum pumps to evacuate the system.

**INFORMATION**

1. Caring for various types of vacuum pumps.
- \* 2. Explaining the effects of mercury in the system.

**AIR CONDITIONING AND REFRIGERATION SERVICING**

- Δ 7. Recognizing the various types of fastening devices.
- Δ 8. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 9. Recognizing the various types and uses of washers.
- Δ 10. Applying the proper methods of removing threaded fasteners.
- Δ 11. Recognizing the difference between right and left hand threads.

#### **TASK 6: REPLACING THE DEFECTIVE COMPONENT(S) IN THE REFRIGERATION UNIT**

##### **COMMUNICATION**

- 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

##### **MEASUREMENT**

- 1. Measuring the inside diameter and outside diameter of tubing with calipers and rule.
- \* 2. Measuring the length of tubing with steel tape to accuracy of 1/8 of an inch.
- \* 3. Measuring refrigerant in system with a pressure gauge.

##### **MATHEMATICS**

- 1. Adding numbers and fractions to determine total length of tubing.

##### **SCIENCE**

- 1. Recognizing the properties of non-ferrous metals when making solderless connections.

##### **SKILLS**

- 1. Demonstrating the proper techniques of using a torch for soldering and un-soldering joints.

- ◊ 2. Cutting tubing to specific length with tubing cutter.
- ◊ 3. Reaming tubing to remove the inside burr with hand reamer.
- ◊ 4. Flaring tubing for coupling with a flaring tool to insure proper seal.
- 5. Charging the refrigeration system with the specified refrigerant.
- 6. Replacing the defective components with the appropriate tools.

#### INFORMATION

- 1. Selecting the proper type of solder recommended for refrigeration sweated joints.
- ◊ 2. Selecting the proper type and size of reamer for the job to be done.
- ◊ 3. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
  - f. Levels
- ◊ 4. Applying the proper care, maintenance & storage of tools.
- ◊ 5. Recognizing the proper methods of holding wrenches.
- ◊ 6. Applying the proper methods of holding work.
- ◊ 7. Applying methods of holding pliers for pulling, pressing and twisting.
- ◊ 8. Recognizing the results of using pliers for removing nuts and bolts.
- ◊ 9. Applying the proper procedures for cutting with diagonal cutters.
- ◊ 10. Determining the proper methods of stripping wire.
- ◊ 11. Recognizing the various types of fastening devices.

- △ 12. Recognizing the various types, uses and characteristics of threaded fasteners.
- △ 13. Recognizing the various types and uses of washers.
- △ 14. Applying the proper methods of installing threaded fasteners.
- △ 15. Recognizing the difference between right and left hand threads.

### **TASK 7: REPLACING COVER ON UNIT TO RESTORE TO ORIGINAL CONDITION**

#### **COMMUNICATION**

1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

#### **SKILLS**

1. Replacing cover plates using the appropriate tools.

#### **INFORMATION**

- △ 1. Selecting the proper type and size of:
 

a. Screwdrivers	d. Cutters
b. Pliers	e. Nutdrivers
c. Wrenches	f. Levels
- △ 2. Applying the proper care, maintenance & storage of tools.
- △ 3. Recognizing the proper methods of holding wrenches.
- △ 4. Applying the proper methods of holding the work.
- △ 5. Applying methods of holding pliers for pulling, pressing and twisting.
- △ 6. Recognizing the results of using pliers for removing nuts and bolts.
- △ 7. Applying the proper procedures for cutting with diagonal cutters.
- △ 8. Determining the proper methods of stripping wire.

- ▲ 9. Recognizing the various types of fastening devices.
- ▲ 10. Recognizing the various types, uses and characteristics of threaded fasteners.
- ▲ 11. Recognizing the various types and uses of washers.
- ▲ 12. Applying the proper methods of installing threaded fasteners.
- ▲ 13. Recognizing the difference between right and left hand threads.

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**BUSINESS MACHINE SERVICING**

**TASK 1: OBSERVING THE SYMPTOMS TO DETERMINE THE DEFECTS IN A TYPEWRITER****COMMUNICATION**

- \* 1. Interpreting the customer complaint concerning the malfunction of the typewriter.

**SKILLS**

- 1. Operating the typewriter in order to observe the malfunction.
- 2. Visually inspecting for obvious defects in the typewriter.

**INFORMATION**

- Ø 1. Explaining the basic operation of the typewriter.

**TASK 2: DISASSEMBLING THE TYPEWRITER FOR CLEANING****COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks:
  - a. Installation procedures and techniques
  - b. Service procedures
  - c. Type, function and rating of the defective part
  - d. Electrical supplies
  - e. Repair and replacement of the components
  - f. Special service tools
  - g. Electrical codes

**SKILLS**

- Ø 1. Removing the ribbon from the typewriter by hand.
- Ø 2. Removing the platen from the typewriter by hand.
- Ø 3. Removing the feed rolls from the typewriter by hand.
- Ø 4. Removing the rubber feet from the typewriter with a screwdriver.

- Δ 5. Removing all other rubber or fabric parts or parts which might be affected by cleaning solution with the appropriate tools.
- Δ 6. Removing the carriage assembly with the appropriate tools.
- Δ 7. Removing all side and cover plates with the appropriate tools.
- Δ 8. Removing screws from various parts of the typewriter with a screwdriver.
- Δ 9. Removing electrical components and connections from the typewriter with the appropriate tools.

#### INFORMATION

- ◊ 1. Recognizing the various parts of the typewriter.
- Δ 2. Selecting the proper type and size of screwdrivers for job to be done:
  - a. Regular
  - b. Ratchet
  - c. Offset
  - d. Spiral
  - e. Insulated
  - f. Wedge, clip (screw holding)
- Δ 3. Selecting the proper types of screwdriver tips:
  - a. Standard slot
  - b. Cross (Phillips)
  - c. Square (Robertson)
  - d. Socket
  - e. Others
- Δ 4. Selecting the proper types of wrenches for the job to be done:
  - a. Open end
  - b. Box end
  - c. Socket
  - d. Adjustable
  - e. Spanner (hook, face, special)
- Δ 5. Selecting proper types and sizes of attachments for socket wrenches:
  - a. Ratchets
  - b. Extensions

- Δ 6. Recognizing the proper methods of holding wrenches.
- Δ 7. Selecting the proper type, size and characteristics of pliers for the work to be done:
  - a. Slip joint
  - b. Combination
  - c. Long, round, and needle nose
  - d. Crimping
  - e. Vise grip
- Δ 8. Applying the proper methods of holding the work.
- Δ 9. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 10. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 11. Selecting the proper types and sizes of cutters for the job to be done:
  - a. Side, end and diagonal
  - b. Wire stripper
  - c. Knives
- Δ 12. Applying the proper procedures for cutting with diagonal cutters.
- Δ 13. Determining the proper methods of stripping wire.
- Δ 14. Selecting the proper size and type of nut-driver to use for the job to be done.
- Δ 15. Applying the proper care, maintenance and storage of tools.
- Δ 16. Recognizing the various types of fastening devices:
  - a. Threaded fasteners
  - b. Keys, rivets and springs
  - c. Cotter pins and shear pins
  - d. Retaining rings
- Δ 17. Recognizing the various types, uses and characteristics of threaded fasteners:
  - a. Bolts and nuts
  - b. Cap screws
  - c. Machine screws
  - d. Set screws
  - e. Sheet metal and self-tapping screws
  - f. Stud bolts

- ▲ 18. Recognizing the various types and uses of washers:
  - a. Flat
  - b. Lock
- ▲ 19. Applying the proper methods of installing threaded fasteners.
- ▲ 20. Recognizing the difference between right and left hand threads.

### **TASK 3: CLEANING TYPEWRITER TO REMOVE DIRT**

#### **COMMUNICATION**

- ◊ 1. Interpreting the directions on cleaning solutions for proper mixing.

#### **MEASUREMENT**

- ◊ 1. Measuring liquids in ounces, pints, quarts, gallons.

#### **SCIENCE**

- ◊ 1. Recognizing the flammable and explosive properties of cleaning solutions.

#### **SKILLS**

- \* 1. Blowing loose dirt from the typewriter with compressed air.
- ◊ 2. Washing the typewriter with water to remove loose dirt.
- ◊ 3. Placing the typewriter in the cleaning solution.
- ◊ 4. Placing the typewriter in an oven to evaporate all possible moisture.
- \* 5. Lubricating the typewriter by spraying with a light oil.

#### **INFORMATION**

- \* 1. Selecting the proper types of solution for cleaning the typewriter.

**2. Applying the proper safety precautions:**

- \* a. Wearing protective clothing when working with cleaning agents & solvents
- \* b. Applying proper ventilating procedures when working with cleaning agents & solvents

**TASK 4: ISOLATING THE MECHANICAL DEFECTS TO A PARTICULAR SECTION OF THE TYPEWRITER**

**COMMUNICATION**

- \* 1. Reading the manufacturer's service reference chart for possible cause of defects.

**MEASUREMENT**

- \* 1. Checking clearances between parts with a feeder gauge.

**SKILLS**

- \* 1. Eliminating the possible cause of the defect until the particular component is found.
- 2. Visually inspecting for broken parts, missing screws or other obvious defects.

**INFORMATION**

- 1. Explaining the basic operation of the typewriter.
- 2. Explaining the function & movement of each part of the typewriter.

**TASK 5: ISOLATING THE ELECTRICAL DEFECTS TO A PARTICULAR COMPONENT OF THE TYPEWRITER**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

- \* 2. Interpreting meter readings to determine the condition of the components.

### SKILLS

- \* 1. Connecting electrical meters in the proper manner.
- \* 2. Inspecting the electrical components with a continuity tester or Volt-Ohm meter to eliminate the possible cause of trouble until the defective component is found.

### INFORMATION

- Ø 1. Recognizing the various parts of the typewriter.
- \* 2. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 3. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 4. Applying the proper care, maintenance and storage of electrical meters.
- \* 5. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.
- Ø 6. Observing safety precautions when working with live circuits.

### **TASK 6: ISOLATING THE MECHANICAL DEFECT(S) TO A PARTICULAR COMPONENT OF THE TYPEWRITER**

### COMMUNICATION

- Ø 1. Interpreting the manufacturer's diagrams to follow the movement of parts in the typewriter.
- \* 2. Reading the manufacturer's service reference chart for possible cause of trouble.

**SKILLS**

1. Visually inspecting for obvious mechanical defects in the typewriter.
- \* 2. Eliminating the possible cause of the defect until the particular section is found.

**INFORMATION**

- Ø 1. Explaining the basic operation of the typewriter.
- Ø 2. Explaining the function & movement of each part of the typewriter.
- Ø 3. Recognizing the various parts of the typewriter.

**TASK 7: REMOVING THE DEFECTIVE PART(S) OF THE TYPEWRITER****COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- Ø 2. Interpreting the manufacturer's diagrams to follow the movement of parts in the typewriter.

**SKILLS**

- Ø 1. Removing the defective part with special tools indicated by the service manual.
- Δ 2. Removing the defective part with the appropriate tools.

**INFORMATION**

- Ø 1. Recognizing the various parts of the typewriter.
- Δ 2. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 3. Applying the proper care, maintenance & storage of tools.

- Δ 4. Recognizing the proper methods of holding wrenches.
- Δ 5. Applying the proper methods of holding the work.
- Δ 6. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 7. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 8. Applying the proper procedures for cutting with diagonal cutters.
- Δ 9. Determining the proper methods of stripping wire.
- Δ 10. Recognizing the various types of fastening devices.
- Δ 11. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 12. Recognizing the various types and uses of washers.
- Δ 13. Applying the proper methods of installing threaded fasteners.
- Δ 14. Recognizing the difference between right and left hand threads.

#### **TASK 8: REPLACING THE DEFECTIVE PART(S) OF THE TYPEWRITER**

##### **COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

##### **SKILLS**

- ∅ 1. Replacing the defective parts with special tools as indicated by service manuals.
- Δ 2. Replacing the defective parts with the appropriate tools.
- \* 3. Lubricating parts to specifications indicated in the service manual.

##### **INFORMATION**

- ∅ 1. Recognition of the various parts of the typewriter.

- Ø 2. Practicing safety precautions noted in the service manual.
- Δ 3. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 4. Applying the proper care, maintenance & storage of tools.
- Δ 5. Recognizing the proper methods of holding wrenches.
- Δ 6. Applying the proper methods of holding the work.
- Δ 7. Applying methods of holding pliers for pulling, pressing, and twisting.
- Δ 8. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 9. Applying the proper procedure for cutting with diagonal cutters.
- Δ 10. Determining the proper methods of stripping wire.
- Δ 11. Recognizing the various types of fastening devices.
- Δ 12. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 13. Recognizing the various types and uses of washers.
- Δ 14. Applying the proper methods of installing threaded fasteners.
- Δ 15. Recognizing the difference between right and left hand threads.

#### **TASK 9: REASSEMBLING THE REPAIRED TYPEWRITER**

##### **COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

SKILLS

- ◊ 1. Reassembling the repaired typewriter with special hand tools as indicated by the service manual.
- Δ 2. Reassembling the repaired typewriter with the appropriate tools.

INFORMATION

- ◊ 1. Recognizing the various parts of the typewriter.
- Δ 2. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 3. Applying the proper care, maintenance & storage of tools.
- Δ 4. Recognizing the proper methods of holding wrenches.
- Δ 5. Applying the proper methods of holding the work.
- Δ 6. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 7. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 8. Applying the proper procedures for cutting with diagonal cutters.
- Δ 9. Determining the proper methods of stripping wire.
- Δ 10. Recognizing the various types of fastening devices.
- Δ 11. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 12. Recognizing the various types and uses of washers.
- Δ 13. Applying the proper methods of installing threaded fasteners.
- Δ 14. Recognizing the difference between right and left hand threads.

**TASK 10: TESTING THE OPERATION OF THE REPAIRED TYPEWRITER****COMMUNICATION**

- \* 1. Interpreting instructions from the service manual for check points on the typewriter.

**SKILLS**

- 1. Operating the typewriter to determine performance.

**INFORMATION**

- Ø 1. Explaining the basic operation of the typewriter.
- Ø 2. Explaining the function and movement of each part of the typewriter.

**TASK 11: DISASSEMBLING THE CALCULATOR FOR CLEANING****COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- Δ 1. Removing all rubber components from the calculator with the appropriate tools.
- Δ 2. Removing the cover plates from the calculator with the appropriate tools.
- Δ 3. Removing all electrical components and connections from the calculator with the appropriate tools.
- Δ 4. Removing screws from various parts of the calculator with a screwdriver.
- Ø 5. Removing the parts of the calculator with special tools indicated by the service manual.
- 6. Removing all parts which might be harmed by the cleaning solution.

INFORMATION

- Ø 1. Recognizing the various parts of the calculator.
- Ø 2. Practicing safety procedures noted in the service manual when disassembling the calculator.
- Δ 3. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 4. Applying the proper care, maintenance & storage of tools.
- Δ 5. Recognizing the proper methods of holding wrenches.
- Δ 6. Applying the proper methods of holding the work.
- Δ 7. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 8. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 9. Applying the proper procedures for cutting with diagonal cutters.
- Δ 10. Determining the proper methods of stripping wire.
- Δ 11. Selecting the proper size & type of nutdriver for the job to be done.
- Δ 12. Recognizing the various types of fastening devices.
- Δ 13. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 14. Recognizing the various types and uses of washers.
- Δ 15. Applying the proper methods of removing threaded fasteners.
- Δ 16. Recognizing the difference between right and left hand threads.

**TASK 12: CLEANING THE CALCULATOR TO REMOVE DIRT**COMMUNICATION

- Ø 1. Interpreting the directions on cleaning solutions for proper mixing.

**MEASUREMENT**

- ◊ 1. Measuring liquids in ounces, pints, quarts, gallons.

**SCIENCE**

- ◊ 1. Recognizing the flammable and explosive properties of cleaning solution.

**SKILLS**

- \* 1. Blowing loose dirt from the calculator with compressed air.
- ◊ 2. Washing the calculator with water to remove loose dirt.
- ◊ 3. Placing the calculator in the cleaning solution.
- ◊ 4. Placing the calculator in an oven to evaporate all possible moisture.
- \* 5. Lubricating the typewriter by spraying with a light oil.

**INFORMATION**

- \* 1. Selecting the proper type of solution for cleaning the calculator.
- 2. Applying the proper safety precautions:
  - \* a. Wearing protective clothing when working with cleaning agents & solvents
  - \* b. Applying the proper ventilating procedures when working with cleaning agents and solvents

**TASK 13: REMOVING THE DEFECTIVE PART(S) OF THE CALCULATOR****COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues service manuals, schematics and handbooks.
- ◊ 2. Interpreting the manufacturer's diagrams to follow the movement of parts in the calculator.

**SKILLS**

- ◊ 1. Removing the defective part with special tools indicated by the service manual.
- ◊ 2. Removing the defective part with the appropriate tools.

**INFORMATION**

- ◊ 1. Practicing safety procedures noted in the service manual when disassembling the calculator.
- \* 2. Arranging the parts in an orderly procedure to prevent loss or damage when disassembling the calculator.
- ◊ 3. Recognizing the various parts of the calculator.

**TASK 14: REPLACING THE DEFECTIVE PART (S) OF THE CALCULATOR****COMMUNICATION**

- ◊ 1. Interpreting drawings, specification, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- ◊ 1. Replacing the defective parts with special tools as indicated by the service manuals.
- ◊ 2. Replacing the defective parts with the appropriate tools.
- \* 3. Lubricating parts to specifications indicated in the service manual.

**INFORMATION**

- ◊ 1. Recognizing the various parts of the calculator.
- ◊ 2. Practicing safety precautions noted in the service manual.
- ◊ 3. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers

- △ 4. Applying the proper care, maintenance & storage of tools.
- △ 5. Recognizing the proper methods of holding wrenches.
- △ 6. Applying the proper methods of holding work.
- △ 7. Applying methods of holding pliers for pulling, pressing and twisting.
- △ 8. Recognizing the results of using pliers for removing nuts and bolts.
- △ 9. Selecting the proper types and sizes of cutters for the job to be done.
- △ 10. Applying the proper procedures for cutting with diagonal cutters.
- △ 11. Determining the proper methods of stripping wire.
- △ 12. Recognizing the various types of fastening devices.
- △ 13. Recognizing the various types, uses, and characteristics of threaded fasteners.
- △ 14. Recognizing the various types and used of washers.
- △ 15. Applying the proper methods of installing threaded fasteners.
- △ 16. Recognizing the difference between right and left hand threads.

#### **TASK 15: REASSEMBLING THE REPAIRED CALCULATOR**

##### **COMMUNICATION**

- △ 1. Interpreting drawings, specification, manufacturer's catalogues, service manuals, schematics and handbooks.

##### **SKILLS**

- ◊ 1. Reassembling the repaired calculator with special tools as indicated by service manual.
- △ 2. Reassembling the repaired calculator with the appropriate tools.

INFORMATION

- ◊ 1. Recognizing the various parts of the calculator.
- Δ 2. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 3. Applying the proper care, maintenance & storage of tools.
- Δ 4. Recognizing the proper methods of holding wrenches.
- Δ 5. Applying the proper methods of holding the work.
- Δ 6. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 7. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 8. Applying the proper procedure for cutting with diagonal cutters.
- Δ 9. Determining the proper methods of stripping wire.
- Δ 10. Recognizing the various types of fastening devices.
- Δ 11. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 12. Recognizing the various types and uses of washers.
- Δ 13. Applying the proper methods of installing threaded fasteners.
- Δ 14. Recognizing the difference between right and left hand threads.

**TASK 16: TESTING THE OPERATION OF THE REPAIRED CALCULATOR**COMMUNICATION

- \* 1. Interpreting instructions from the service manual for check points on the calculator.

**SKILLS**

1. Operating the calculator to determine performance.

**INFORMATION**

- Ø 1. Explaining the basic operation of the calculator.
- Ø 2. Explaining the function & movement of each part of the calculator.

**TASK 17: DISASSEMBLING THE ADDING MACHINE FOR CLEANING****COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- Ø 1. Removing the ribbon from a printing type adding machine.
- Ø 2. Removing the platen from a printing type adding machine.
- Ø 3. Removing the feed rolls from a printing type adding machine.
- Ø 4. Removing the rubber feet from a printing type adding machine.
- Ø 5. Removing all other rubber or fabric parts or parts which might be effected by cleaning solution.
- Δ 6. Removing all side and cover plates with the appropriate tools.
- Δ 7. Removing screws from the various parts of the typewriter with a screwdriver.

**INFORMATION**

- Ø 1. Recognizing the various parts of the adding machine.
- Ø 2. Practicing safety procedures noted in the service manual when disassembling the adding machine.

▲ 3. Selecting the proper type and size of:

- a. Screwdrivers
- b. Pliers
- c. Wrenches
- d. Cutters
- e. Nutdrivers

▲ 4. Applying the proper care, maintenance & storage of tools.

▲ 5. Recognizing the proper methods of holding wrenches.

▲ 6. Applying the proper methods of holding the work.

▲ 7. Applying methods of holding pliers for pulling, pressing and twisting.

▲ 8. Recognizing the results of using pliers for removing nuts and bolts.

▲ 9. Applying the proper procedures for cutting with diagonal cutters.

▲ 10. Determining the proper methods of stripping wire.

▲ 11. Recognizing the various types of fastening devices.

▲ 12. Recognizing the various types, uses and characteristics of threaded fasteners.

▲ 13. Recognizing the various types and uses of washers.

▲ 14. Applying the proper methods of removing threaded fasteners.

▲ 15. Recognizing the difference between right and left hand threads.

**TASK 18: CLEANING THE ADDING MACHINE TO REMOVE DIRT**

**COMMUNICATION**

φ 1. Interpreting the directions on cleaning solutions for proper mixing.

**MEASUREMENT**

φ 1. Measuring liquids in ounces, pints, quarts and gallons.

**SCIENCE**

- Ø 1. Recognizing the flammable and explosive properties of cleaning solutions.

**SKILLS**

- \* 1. Blowing loose dirt from the adding machine with compressed air.
- Ø 2. Washing the adding machine with water to remove loose dirt.
- Ø 3. Placing the adding machine in the cleaning solution.
- Ø 4. Placing the adding machine in an oven to evaporate all possible moisture.
- \* 5. Lubricating the typewriter by spraying with a light oil.

**INFORMATION**

- \* 1. Selecting the proper type of solution for cleaning the adding machine.
- 2. Applying the proper safety precautions:
  - \* a. Wearing protective clothing when working with cleaning agents & solvents
  - \* b. Applying proper ventilating procedures when working with cleaning agents & solvents

**TASK 19: REMOVING THE DEFECTIVE PART(S) OF THE ADDING MACHINE****COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- Ø 2. Interpreting the manufacturer's diagrams to follow the movement of parts in the adding machine.

**SKILLS**

- Ø 1. Removing the defective part with special tools indicated by the service manual.

2. Removing the defective part with the appropriate tools.

INFORMATION

1. Following parts movement from the adding machine service manual.
2. Practicing safety procedures noted in the service manual.
3. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
4. Applying the proper care, maintenance & storage of tools.
5. Recognizing the proper methods of holding wrenches.
6. Applying the proper methods of holding the work.
7. Applying methods of holding pliers for pulling, pressing and twisting.
8. Recognizing the results of using pliers for removing nuts and bolts.
9. Applying the proper procedures for cutting with diagonal cutters.
10. Determining the proper methods of stripping wire.
11. Recognizing the various types of fastening devices.
12. Recognizing the various types, uses and characteristics of threaded fasteners.
13. Recognizing the various types and uses of washers.
14. Applying the proper methods of installing threaded fasteners.
15. Recognizing the difference between right and left hand threads.

**TASK 20: REPLACING THE DEFECTIVE PART(S) OF THE ADDING MACHINE****COMMUNICATION**

- ▲ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- ◊ 1. Replacing the defective part with special tools as indicated by the service manual.
- ▲ 2. Replacing the defective part with the appropriate tools.
- \* 3. Lubricating the parts to specifications indicated in the service manual.

**INFORMATION**

- 1. Recognizing the various parts of the adding machine.
- ◊ 2. Practicing safety precautions noted in service manual.
- ▲ 3. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
  - f. Hammers
  - g. Chisels
  - h. Punches
  - i. Pullers
  - j. Levels
- ▲ 4. Applying the proper care, maintenance & storage of tools.
- ▲ 5. Recognizing the proper methods of holding wrenches.
- ▲ 6. Applying the proper methods of holding the work.
- ▲ 7. Applying methods of holding pliers for pulling, pressing and twisting.
- ▲ 8. Recognizing the results of using pliers for removing nuts and bolts.
- ▲ 9. Applying the proper procedures for cutting with diagonal cutters.

- Δ 10. Determining the proper methods of stripping wire.
- Δ 11. Recognizing the various types of fastening devices.
- Δ 12. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 13. Recognizing the various types and uses of washers.
- Δ 14. Applying the proper methods of installing threaded fasteners.
- Δ 15. Recognizing the difference between right and left hand threads.

#### **TASK 21: REASSEMBLING THE REPAIRED ADDING MACHINE**

##### **COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

##### **SKILLS**

- ∅ 1. Reassembling the repaired adding machine with special tools as indicated by the service manual.
- Δ 2. Reassembling the repaired adding machine with the appropriate tools.

##### **INFORMATION**

- ∅ 1. Recognizing the various parts of the adding machines.
- Δ 2. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 3. Applying the proper care, maintenance & storage of tools.
- Δ 4. Recognizing the proper methods of holding wrenches.
- Δ 5. Applying the proper methods of holding the work.

- ▲ 6. Applying methods of holding pliers for pulling, pressing and twisting.
- ▲ 7. Recognizing the results of using pliers for removing nuts and bolts.
- ▲ 8. Applying the proper procedures for cutting with diagonal cutters.
- ▲ 9. Determining the proper methods of stripping wire.
- ▲ 10. Recognizing the various types of fastening devices.
- ▲ 11. Recognizing the various types, uses and characteristics of threaded fasteners.
- ▲ 12. Recognizing the various types and uses of washers.
- ▲ 13. Applying the proper methods of installing threaded fasteners.
- ▲ 14. Recognizing the difference between right and left hand threads.

## **TASK 22: TESTING THE OPERATION OF THE REPAIRED ADDING MACHINE**

### **COMMUNICATION**

- \* 1. Interpreting instructions from the service manual for check points.

### **SKILLS**

- 1. Operating the adding machine to determine performance.

### **INFORMATION**

- φ 1. Explaining the basic operation of the adding machine.
- 2. Explaining the function & movement of each part of the adding machine.

**HOME APPLIANCE SERVICING**

**TASK 1: OBSERVING THE SYMPTOMS TO DETERMINE THE DEFECT(S) IN SMALL HEATING ELEMENT APPLIANCES**

**COMMUNICATION**

- \* 1. Interpreting the customers complaint concerning the malfunction of the appliance.
- Ø 2. Writing the malfunctions of the appliance on a service ticket.

**SKILLS**

- Ø 1. Operating the appliance in order to observe the malfunction.
- 2. Visually inspecting for obvious defects in the appliance.
- \* 3. Visually inspecting for obvious defects in the cord and plug on the appliance

**INFORMATION**

- Ø 1. Explaining the basic operation of the appliance.

**TASK 2: DISASSEMBLING SMALL HEATING ELEMENT APPLIANCES FOR TESTING AND REPAIRING**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks to determine:
  - a. Installation procedures and techniques
  - b. Service procedures
  - c. Type, function and rating of defective part
  - d. Electrical supplies
  - e. Repair and replacement of components
  - f. Special service tools
  - g. Electrical codes

**SKILLS**

- Δ 1. Removing the fasteners and the cover plate of the appliance with the appropriate tools.

**INFORMATION**

1. Selecting the proper type and size of screwdrivers for the job to be done.

- a. Regular
- b. Ratchet
- c. Offset
- d. Spiral
- e. Insulated
- f. Wedge, clip (screw holding)

▲ 2. Selecting the proper types of screwdriver tips:

- a. Standard slot
- b. Cross (Phillips)
- c. Square (Robertson)
- d. Socket
- e. Others

▲ 3. Selecting the proper types of wrenches for the job to be done:

- a. Open end
- b. Box end
- c. Socket
- d. Adjustable
- e. Spanner (hook, face, special)

▲ 4. Selecting proper types and sizes of attachments for socket wrenches:

- a. Ratchets
- b. Extensions.

▲ 5. Recognizing the proper methods of holding wrenches.

▲ 6. Selecting the proper type, size and characteristics of pliers for the work to be done:

- a. Slip joint
- b. Combination
- c. Long, round, and needle nose
- d. Crimping
- e. Vise grip

▲ 7. Applying the proper methods of holding the work.

▲ 8. Applying methods of holding pliers for pulling, pressing and twisting.

▲ 9. Recognizing the results of using pliers for removing nuts and bolts.

- Δ 10. Selecting the proper types and sizes of cutters for the job to be done:
  - a. Side, end and diagonal
  - b. Wire stripper
  - c. Knives
- Δ 11. Applying the proper procedures for cutting with diagonal cutters.
- Δ 12. Determining the proper methods of stripping wire.
- Δ 13. Selecting the proper size & type of nutdriver for the job to be done.
- Δ 14. Applying the proper care, maintenance and storage of tools.
- Δ 15. Recognizing the various types of fastening devices:
  - a. Threaded fasteners
  - b. Keys, rivets and springs
  - c. Cotter pins and shear pins
  - d. Retaining rings
- Δ 16. Recognizing the various types, uses and characteristics of threaded fasteners:
  - a. Bolts and nuts
  - b. Cap screws
  - c. Machine screws
  - d. Set screws
  - e. Sheet metal and self-tapping screws
  - f. Stud bolts
- Δ 17. Recognizing the various types and uses of washers:
  - a. Flat
  - b. Lock
- Δ 18. Applying the proper methods of installing threaded fasteners.
- Δ 19. Recognizing the difference between right and left hand threads.
- 20. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present

- \* d. Disconnecting the appliance from the power supply before starting repair operations
- \* e. Properly grounding the appliance

**TASK 3: ISOLATING THE DEFECT TO A PARTICULAR SECTION OF THE HEATING ELEMENT APPLIANCE**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Reading the manufacturer's service reference chart for possible causes of the trouble.
- \* 3. Interpreting meter readings to determine the condition of the components.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

**SCIENCE**

- \* 1. Explaining the electron theory of current flow in the appliance.

**SKILLS**

- Ø 1. Visually inspecting for obvious electrical defects in the appliance.
- \* 2. Connecting electrical meters in the proper manner.
- \* 3. Inspecting the electrical components with the appropriate electrical meters to locate the defective section.
- \* 4. Determining voltage, and resistance in the appliance with a Volt-Ohm meter.

**INFORMATION**

- Ø 1. Explaining the basic operation of the appliance.

**2. Applying the proper safety precautions:**

- \* a. Wearing safety shoes with non-conducting soles
- \* b. Removing jewelry & items of clothing containing metal
- \* c. Avoiding work situations where moisture is present
- \* d. Disconnecting the appliance from the power supply before starting repair operations
- e. Properly grounding the appliance
- \* 3. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 4. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 5. Applying the proper care, maintenance & storage of electrical meters.
- \* 6. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.

**TASK 4: ISOLATING THE DEFECT TO A PARTICULAR COMPONENT OF THE HEATING ELEMENT APPLIANCE**

**COMMUNICATION**

- 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting meter readings to determine condition of the components.
- \* 3. Interpreting instructions and information located on the data plate of the unit.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

**SCIENCE**

- \* 1. Explaining the electron theory of current flow in the appliance.

**SKILLS**

- ▲ 1. Connecting the electrical meters in the proper manner.
- ▲ 2. Inspecting the switch in the heating element appliance for defects with a continuity tester or the appropriate electrical meter.
- ▲ 3. Inspecting the heating element assembly for defects with a continuity tester or the appropriate electrical meter.
- ▲ 4. Inspecting the internal wiring connections for defects with a continuity tester or the appropriate electrical meter.
- \* 5. Determining voltage and resistance in the appliance with a Volt-Ohm meter.
- \* 6. Visually inspecting for obvious defects in the cord and plug on the appliance.

**INFORMATION**

- ◊ 1. Applying the proper methods of checking for electrical grounds.
- 2. Inspecting for defective accessories:
  - a. Blanket and pad materials
  - b. Plastic feet & handles
  - c. Insulation
  - d. Pilot lights
  - e. Grill plates
- \* 3. Recognizing the importance of proper connections when using the appropriate electrical meters.
- \* 4. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 5. Applying the proper care, maintenance & storage of electrical meters.

- \* 6. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.
- 7. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

**TASK 5: REPLACING THE DEFECTIVE PART(S) OF SMALL HEATING ELEMENT APPLIANCES**

**COMMUNICATION**

- △ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage, and resistance.

**SCIENCE**

- \* 1. Explaining the characteristics of series and parallel circuits used in the appliance.

**SKILLS**

- △ 1. Replacing open type heating element coils with the appropriate tools.
- △ 2. Replacing heating elements and insulators with the appropriate tools.
- △ 3. Replacing broken or damaged wires with the appropriate tools.
- 4. Tying underwriters knot when replacing a plug.

5. Repairing breaks in open-type coils with solderless connections using crimping pliers.
- \* 6. Replacing the defective cord and/or plug.

### INFORMATION

1. Selecting the proper types of heating elements for a particular appliance:
  - a. Open
  - b. Sealed
  - c. Glass panel
  - d. Infrared
  - e. Thermo-electric
2. Identifying different types, purposes, and uses of terminal blocks.
3. Recognizing the proper methods of mounting and wiring heating elements.
4. Recognizing the necessity of setting range surface heating element level and flat.
5. Recognizing the importance of even stretching when installing open type heating elements.
- Δ 6. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 7. Recognizing the proper methods of holding wrenches.
- Δ 8. Applying the proper methods of holding the work.
- Δ 9. Applying methods of holding pliers for pulling, pressing, and twisting.
- Δ 10. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 11. Applying the proper procedures for cutting with diagonal cutters.
- Δ 12. Determining the proper methods of stripping wire.
- Δ 13. Recognizing the various types of fastening devices.

- △ 14. Recognizing the various types, uses and characteristics of threaded fasteners.
- △ 15. Recognizing the various types and uses of washers.
- △ 16. Applying the proper methods of installing threaded fasteners.
- △ 17. Recognizing the difference between right and left hand threads.
- 18. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance
- ∅ 19. Explaining the importance of observing recommended procedures when tightening down plates, covers, and flanges.

#### **TASK 6: TESTING THE OPERATIONS OF THE REPAIRED SMALL HEATING ELEMENT APPLIANCES**

#### **COMMUNICATION**

- \* 1. Interpreting meter readings to determine the condition of the components.

#### **MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

#### **SCIENCE**

- ∅ 1. Explaining the function of conductors and insulators.

Ø 2. Explaining the various method of heat transfer:

- a. Conduction
- b. Convection
- c. Radiation

SKILLS

- \* 1. Determining voltage and resistance in the appliance with a volt-Ohm meter.
- \* 2. Connecting the electrical meters in the proper manner.

INFORMATION

- \* 1. Inspecting the electrical components with the appropriate electrical meters.
- \* 2. Recognizing the importance of proper connections when using the appropriate electrical meters.
- \* 3. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 4. Applying the proper care, maintenance and storage of electrical meters.
- \* 5. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.

**TASK 7: REASSEMBLING THE REPAIRED SMALL HEATING ELEMENT APPLIANCE**

COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

SKILLS

- Δ 1. Replacing the fasteners and cover plates with the appropriate tools.

- φ 2. Cleaning all dirty components with a small brush.
- φ 3. Dressing contacts on plug-in type elements with abrasive cloth.
- Δ 4. Applying lubricant on linkage and levers of the appliance.

#### INFORMATION

- φ 1. Applying the proper methods of checking for electrical grounds.
- φ 2. Recognizing the various parts of the appliance.
- Δ 3. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 4. Applying the proper care, maintenance and storage of tools.
- Δ 5. Recognizing the proper methods of holding wrenches.
- Δ 6. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 7. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 8. Applying the proper procedures for cutting with diagonal cutters.
- Δ 9. Determining the proper methods of stripping wire.
- Δ 10. Recognizing the various types of fastening devices.
- Δ 11. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 12. Recognizing the various types and uses of washers.
- Δ 13. Applying the proper methods of installing threaded fasteners.
- Δ 14. Recognizing the difference between right and left hand threads.

15. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance
- Ø 16. Explaining the importance of observing recommended procedures when tightening down plates, covers, and flanges.

**TASK 8: RETESTING THE ASSEMBLED SMALL HEATING ELEMENT APPLIANCE**

**COMMUNICATION**

- \* 1. Interpreting instructions from the service manual for check points.

**SKILLS**

- Ø 1. Operating the appliance to determine performance.

**INFORMATION**

1. Explaining the basic operation of the appliance.

**TASK 9: OBSERVING THE SYMPTOMS TO DETERMINE THE DEFECT(S) IN SMALL MOTOR DRIVEN APPLIANCES**

**COMMUNICATION**

- \* 1. Interpreting the customers complaint concerning the malfunction of the appliance.
- Ø 2. Writing the malfunctions of the appliance on a service ticket.

SKILLS

- ◊ 1. Operating the appliance in order to observe the malfunction.
- 2. Visually inspecting for obvious defects in the appliance.
- \* 3. Visually inspecting for obvious defects in the cord and plug on the appliance.

INFORMATION

- 1. Explaining the basic operation of the appliance.

**TASK 10: DISASSEMBLING SMALL ELECTRIC MOTOR APPLIANCES FOR TESTING AND REPAIRING**

COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

SKILLS

- Δ 1. Removing fasteners and cover plates of the appliance with the appropriate tools.
- \* 2. Removing soldered connections with a soldering iron.

INFORMATION

- Δ 1. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 2. Applying the proper care, maintenance & storage of tools.
- Δ 3. Recognizing the proper methods of holding wrenches.
- Δ 4. Applying the proper methods of holding work.
- \* Δ 5. Applying methods of holding pliers for pulling, pressing, and twisting.

- Δ 6. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 7. Applying the proper procedures for cutting with diagonal cutters.
- Δ 8. Determining the proper methods of stripping wire.
- Δ 9. Recognizing the various types of fastening devices.
- Δ 10. Recognizing the various types, uses, and characteristics of threaded fasteners.
- Δ 11. Recognizing the various types and uses of washers.
- Δ 12. Applying the proper methods of removing threaded fasteners.
- Δ 13. Recognizing the difference between right and left hand threads.
- 14. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance
- \* 15. Selecting the proper types and size soldering irons.
- \* 16. Selecting the proper types of tips for soldering irons.
- \* 17. Recognizing the importance of tinning the tip of the soldering iron.
- \* 18. Determining the correct composition of solders to use on the appliance.
- \* 19. Recognizing the importance and purposes of flux when soldering.
- \* 20. Applying the proper methods of transferring heat to work.
- \* 21. Selecting the correct solders and fluxes.
- \* 22. Selecting the proper methods of applying solder.

**TASK 11: ISOLATING THE MECHANICAL DEFECTS TO A PARTICULAR SECTION OF THE SMALL ELECTRIC MOTOR APPLIANCES**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Reading the manufacturer's service reference charts for possible causes of trouble.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

**SCIENCE**

- \* 1. Explaining the theory of electron flow in the appliance.

**SKILLS**

- ∅ 1. Visually inspecting for obvious defects in the appliance.
- \* 2. Inspecting the appliance for defects with a continuity tester or Volt-Ohm meter.
- \* 3. Eliminating the possible causes of defects until the particular defective section of the appliance is found.
- Δ 4. Connecting electrical meters in the proper manner.

**INFORMATION**

- ∅ 1. Applying the proper methods of checking for electrical grounds.
- ∅ 2. Applying the proper procedure of tracing electrical circuits.
- 3. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present

- \* d. Disconnecting the appliance from the power supply before starting repair operations
- \* e. Properly grounding the appliance

**TASK 12: ISOLATING THE ELECTRICAL DEFECT(S) TO A PARTICULAR SECTION OF THE SMALL ELECTRIC MOTOR APPLIANCES**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting the meter readings to determine the condition of the components.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

**SCIENCE**

- \* 1. Explaining the electron theory of current flow in the appliance.

**SKILLS**

- \* 1. Connecting electrical meters in the proper manner.
- Δ 2. Inspecting the switch in the appliance for defects with a continuity tester or the appropriate electrical meters.
- Δ 3. Inspecting the internal wiring connections for defects with a continuity tester or the appropriate electrical meters.
- Δ 4. Visually inspecting for obvious defects in the cord and plug on the appliance.
- 5. Inspecting for defective accessories:
  - a. Heaters
  - b. Brushes
  - c. Magnets
  - d. Cutters
  - e. Blades
  - f. Batteries

- Δ 6. Inspecting the small motor appliance for defects with a continuity tester or the appropriate electrical meters.
- Φ 7. Cleaning dirty components with a small brush.

### INFORMATION

- Φ 1. Applying the proper methods of checking for electrical grounds.
- Φ 2. Applying the proper procedure for tracing electrical circuits.
- \* 3. Determining the correct methods of inspecting, checking, and calibrating electrical meters to know standards.
- \* 4. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 5. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 6. Applying the proper care, maintenance & storage of electrical meters.
- 7. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

**TASK 13: ISOLATING THE DEFECT TO A PARTICULAR COMPONENT OF THE SMALL ELECTRIC MOTOR APPLIANCE**

**COMMUNICATION**

- ▲ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting the meter readings to determine the condition of the components.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage, and resistance.

**SCIENCE**

- \* 1. Explaining the electron theory of current flow in the appliance.
- \* 2. Explaining the characteristics of series and parallel circuits used in the appliance.

**SKILLS**

- \* 1. Inspecting the switch in the small electric motor appliance for defects with a continuity tester or the appropriate electrical meters.
- \* 2. Inspecting the internal wiring connections for defects with a continuity tester or the appropriate electrical meters.
- ▲ 3. Visually inspecting for obvious defects in the cord and plug on the appliance.
- \* 4. Connecting electrical meters in the proper manner.
- 5. Inspecting for defective accessories:
  - a. Heaters
  - b. Brushes
  - c. Magnets
  - d. Cutters
  - e. Blades
  - f. Batteries
- 6. Inspecting for defective condensers, resistors and thermostats.

- Ø 7. Cleaning dirty components with a small brush.

#### INFORMATION

- Ø 1. Applying the proper procedure for diagnosing incorrect operation or malfunction.
- Ø 2. Applying the proper methods of checking for electrical grounds.
- Ø 3. Applying the proper procedure for tracing electrical circuits.
- \* 4. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 5. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 6. Applying the proper care, maintenance & storage of electrical meters.
- \* 7. Determining the correct methods of inspecting, checking, and calibrating electrical meters to known standards.
- 8. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - f. Properly grounding the appliance

**TASK 14: REPLACING THE DEFECTIVE PART(S) OF THE SMALL ELECTRIC MOTOR APPLIANCES****COMMUNICATION**

- △ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- ∅ 1. Cleaning all dirty components with a small brush.
- ∅ 2. Dressing the contacts on plug-in type elements with abrasive cloth.
- \* 3. Soldering wires and electrical connections with a soldering iron.

**INFORMATION**

- △ 1. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- △ 2. Applying the proper care, maintenance and storage of tools.
- △ 3. Recognizing the proper methods of holding wrenches.
- △ 4. Applying the proper methods of holding the work.
- △ 5. Applying methods of holding pliers for pulling, pressing, and twisting.
- △ 6. Recognizing the results of using pliers for removing nuts and bolts.
- △ 7. Applying the proper procedures for cutting with diagonal cutters.
- △ 8. Determining the proper methods of stripping wire.
- \* 9. Selecting the proper types and size soldering irons.
- \* 10. Selecting the proper types of tips for soldering irons.

- \* 11. Recognizing the importance of tinning the tip of the soldering iron.
- \* 12. Determining the correct composition of solders to use on the appliance.
- \* 13. Recognizing the importance and purposes of flux when soldering.
- \* 14. Applying the proper method of transferring heat to work.
- \* 15. Selecting the correct solder and flux.
- \* 16. Selecting the proper method of applying solder.
- Δ 17. Recognizing the various types of fastening devices.
- Δ 18. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 19. Recognizing the various types and uses of washers.
- Δ 20. Applying the proper methods of installing threaded fasteners.
- Δ 21. Recognizing the difference between right and left hand threads.
- 22. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

#### **TASK 15: TESTING THE OPERATION OF THE REPAIRED SMALL ELECTRIC MOTOR APPLIANCES**

#### **COMMUNICATION**

- \* 1. Interpreting the meter readings to determine the condition of the components.

MATHEMATICS

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

SCIENCE

- \* 1. Explaining the characteristics of series and parallel circuits.
- Ø 2. Explaining the various methods of heat transfer.
- Ø 3. Explaining the function of conductors and insulators.

SKILLS

- \* 1. Connecting electrical meter in the proper manner.
- \* 2. Inspecting the appliance for defects with a continuity tester or the appropriate electrical meters.

INFORMATION

- \* 1. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 2. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 3. Applying the proper care, maintenance and storage of electrical meters.
- \* 4. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.

**TASK 16: REASSEMBLING THE REPAIRED SMALL ELECTRIC MOTOR APPLIANCES**COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

SKILLS

- Δ 1. Replacing fasteners and cover plates with the appropriate tools.
- ∅ 2. Cleaning all dirty components with a small brush.

INFORMATION

- ∅ 1. Recognizing the various parts of the appliance.
- Δ 2. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 3. Recognizing the proper methods of holding wrenches.
- Δ 4. Applying the proper methods of holding the work.
- Δ 5. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 6. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 7. Applying the proper procedure for cutting with diagonal cutters.
- Δ 8. Determining the proper methods of stripping wire.
- ∅ 9. Explaining the importance of observing recommended procedure when tightening down plates, covers, and flanges.
- 10. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

**TASK 17: RETESTING THE REPAIRED SMALL ELECTRIC MOTOR APPLIANCES**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting the meter readings to determine the condition of the components.

**SKILLS**

- Ø 1. Operating the appliance to determine performance.
- \* 2. Connecting electrical meter in the proper manner.
- \* 3. Inspecting the appliance for defects with a continuity tester or the appropriate electrical meters.

**INFORMATION**

- 1. Explaining the basic operation of the appliance.
- \* 2. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 3. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 4. Applying the proper care, maintenance and storage of electrical meters.
- \* 5. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.

**TASK 18: CONNECTING THE ELECTRICAL SUPPLY TO THE ELECTRIC RANGE IN THE HOME**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks:

- a. Installation procedures and techniques
- b. Service procedures
- c. Type, function and rating of defective part
- d. Electrical supplies
- e. Repair and replacement of components
- f. Special service tools
- g. Electrical codes

\* 2. Interpreting instructions and information located on the data plate of the unit.

\* 3. Interpreting the meter readings to determine the electrical values at the service outlet.

#### MEASUREMENT

- Ø 1. Measuring voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.
- Ø 2. Measuring current at the service outlet with an amp-probe to determine the amount of current available for the appliance.

#### SKILLS

- Ø 1. Connecting the receptacle to the power line with a screwdriver.
- Ø 2. Connecting a pigtail to the electric range with a screwdriver.
- \* 3. Connecting electrical meters in the proper manner to determine if there is sufficient electrical power to operate the appliance.

#### INFORMATION

- \* 1. Applying the proper safety precautions by properly grounding the appliance.
- Ø 2. Following safety procedures when working with live circuits.
- Δ 3. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers

- △ 4. Applying the proper care, maintenance & storage of tools.
- △ 5. Recognizing the proper methods of holding wrenches.
- △ 6. Applying the proper methods of holding the work.
- △ 7. Applying methods of holding pliers for pulling, pressing and twisting.
- △ 8. Recognizing the results of using pliers for removing nuts and bolts.
- △ 9. Applying the proper procedures for cutting with diagonal cutters.
- △ 10. Determining the proper methods of stripping wire.
- ◊ 11. Preventing damage to the finished surfaces when installing the electric range.
- \* 12. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 13. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Contunity tester
  - d. Volt-Ohm meter
- \* 14. Applying the proper care, maintenance and storage of electrical meters.
- \* 15. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.

**TASK 19: CHECKING THE INSTALLATION OF THE ELECTRIC RANGE AND MAKING ANY FINAL ADJUSTMENTS NECESSARY**

**COMMUNICATION**

- △ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

SKILLS

1. Mounting accessories on the electric range with the appropriate tools.
2. Manually setting controls and timing devices of the electric range.
- Ø 3. Leveling the electric range with a level.

INFORMATION

- Δ 1. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
  - f. Levels
- Δ 2. Applying the proper care, maintenance & storage of tools.
- Δ 3. Recognizing the proper methods of holding wrenches.
- Δ 4. Applying the proper methods of holding the work.
- Δ 5. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 6. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 7. Applying the proper procedures for cutting with diagonal cutters.
- Δ 8. Determining the proper methods of stripping wire.
- Δ 9. Recognizing the various types of fastening devices.
- Δ 10. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 11. Recognizing the various types and uses of washers.
- Δ 12. Applying the proper methods of installing threaded fasteners.
- Δ 13. Recognizing the difference between right and left hand threads.

**TASK 20: EXPLAINING THE OPERATION OF THE ELECTRIC RANGE TO THE CUSTOMER**

**COMMUNICATION**

1. Interpreting the instruction manual concerning the operating procedure of the electric range.
2. Explaining the operation of oven controls.
3. Explaining the operation of the heating elements.
4. Explaining the operation of the accessories.

**SKILLS**

1. Demonstrating the operation of the electric range to the customer.

**INFORMATION**

1. Explaining the operation of the various types of ranges:
  - a. Conventional
  - b. Built-in
  - c. Table top

**TASK 21: INSTALLING THE VENT SYSTEM FOR THE AUTOMATIC DRYER IN THE HOME**

**COMMUNICATION**

1. Interpreting the manufacturer's specifications for the proper venting of the automatic dryer.

**MEASUREMENT**

- \* 1. Measuring vent opening for size with steel tape.
- \* 2. Measuring length of duct necessary with steel tape.

**SKILLS**

1. Visually inspecting walls, windows or drain for best location of vent.

2. Installing the proper size and length of duct between dryer and exhaust hood.
3. Installing the exhaust hood at least 12 inches from the ground.
4. Installing the vent system in either of the following manners:
  - a. Through the floor
  - b. Through the basement window
  - c. Through the outside wall
5. Removing window pane and replacing with sheet metal of same dimensions.
6. Installing exhaust hood in sheet metal window insert.
7. Cutting hole in wood, plaster, brick or concrete for mounting exhaust hood through floor or outside wall using the appropriate tools.

#### INFORMATION

1. Determining the type of vent necessary based on dryer location.
2. Recognizing the importance of checking vent duct for leaks.
3. Recognizing the various types of vents and the necessity of venting the dryer.
4. Selecting and using rulers, inside and outside calipers to determine the required dimensions.
- △ 5. Recognizing the various types, uses and characteristics of threaded fasteners.
- △ 6. Recognizing the various types and uses of washers.
- △ 7. Recognizing the various types of fastening devices.
- △ 8. Applying the proper methods of installing threaded fasteners.
- △ 9. Recognizing the difference between right and left hand threads.
10. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers

Ø 11. Selecting the proper type & size of hammer for the job to be done:

- a. Ball-peen
- b. Claw
- c. Soft-faced

Ø 12. Selecting the proper type & size of chisel for the job to be done:

- a. Wood
- b. Metal
- c. Cold

Ø 13. Selecting the proper type & size of punches for the job to be done:

- a. Tapered
- b. Parallel

Δ 14. Applying the proper care, maintenance and storage of tools.

#### **TASK 22: CONNECTING THE ELECTRICAL SUPPLY TO THE AUTOMATIC DRYER IN THE HOME**

##### **COMMUNICATION**

Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

##### **MEASUREMENT**

Ø 1. Measuring voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.

Ø 2. Measuring current at the service outlet with an Amp-probe to determine the amount of current available to the appliance.

##### **SKILLS**

\* 1. Connecting electrical meters in the proper manner.

Ø 2. Connecting ground to the dryer using a screwdriver and pliers.

Ø 3. Connecting pigtail to the electric dryer using a screwdriver.

- ◊ 4. Connecting a receptacle to the power line using screwdriver.
- Δ 5. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
- Δ 6. Applying methods of holding the pliers for pulling, pressing and twisting.
- Δ 7. Recognizing the results of using pliers for removing nuts and bolts.
- ◊ 8. Recognizing the importance of following electrical code.
- ◊ 9. Applying the proper methods of preventing damage to finished surfaces.
- \* 10. Recognizing the importance of proper connections when using the appropriate electrical meters.
- \* 11. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 12. Applying the proper care, maintenance and storage of electrical meters.
- \* 13. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.

**TASK 23: TESTING THE INSTALLATION OF THE AUTOMATIC DRYER AND MAKING ANY FINAL ADJUSTMENTS NECESSARY**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- ◊ 1. Leveling the automatic dryer to insure proper performance with a level.

2. Operating the dryer and inspecting for correct operation.

INFORMATION

Ø 1. Selecting the proper level for the job to be done.

**TASK 24: EXPLAINING THE OPERATION OF THE AUTOMATIC DRYER TO THE CUSTOMER**

COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- 2. Explaining the importance and method of cleaning the lint trap.
- 3. Explaining the methods of protecting the finish on the automatic dryer.
- 4. Explaining the care & cleaning of dryer drum.
- 5. Instructing the customer in loading dryer.

**TASK 25: CONNECTING THE WATER SUPPLY TO THE AUTOMATIC WASHER IN THE HOME**

COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

MEASUREMENT

- \* 1. Measuring the drain hose to proper length using a steel tape.

SKILLS

- Ø 1. Installing the water hoses using water pump pliers.
- Ø 2. Connecting the drain hose to the washing machine using water pump pliers.

INFORMATION

- Ø 1. Recognizing the importance of checking for water leaks at all connections.
- 2. Recognizing the hot and cold water lines.
- Δ 3. Recognizing the various types of fastening devices.
- Δ 4. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 5. Recognizing the various types and uses of washers.
- Δ 6. Applying the proper methods of installing threaded fasteners.
- Δ 7. Recognizing the difference between right & left hand threads.

**TASK 26: CONNECTING THE ELECTRICAL SUPPLY TO THE AUTOMATIC WASHER IN THE HOME**COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting instructions and information located on the data plate of the unit.
- \* 3. Interpreting the meter readings to determine the electrical values at the service outlet.

MEASUREMENT

- Ø 1. Measuring voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.
- Ø 2. Measuring current at the service outlet with an Amp-probe to determine the amount of current available for the appliance.

SKILLS

- \* 1. Connecting electrical meters in the proper manner to determine if there is sufficient electrical power to operate the appliance.

- Ø 2. Connecting a ground to the washer with screwdriver and pliers.
- \* 3. Plugging the line cord into the receptacle.

### INFORMATION

- \* 1. Applying the proper safety precautions by properly grounding the appliance.
- 2. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
- Δ 3. Selecting the proper type, size and characteristics of pliers for the work to be done.
- Δ 4. Applying the proper methods of holding the work.
- Δ 5. Applying proper care and maintenance of pliers.
- Δ 6. Applying methods of holding pliers for pulling, pressing, and twisting.
- Δ 7. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 8. Preventing damage to finished surfaces when installing the appliance.
- 9. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Properly grounding the appliance
- \* 10. Recognizing the importance of proper connections when using the appropriate electrical meters.
- \* 11. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter

- \* 12. Applying the proper care, maintenance and storage of electrical meters.
- \* 13. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.

**TASK 27: CHECKING THE INSTALLATION OF THE AUTOMATIC WASHER AND  
MAKING ANY FINAL ADJUSTMENTS NECESSARY**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- ∅ 1. Leveling the automatic washing machine to insure proper performance.
- 2. Inspecting the water hose and connections for leaks.
- 3. Inspecting the drain hoses for leaks.
- 4. Operating the washer and checking for proper water temperature in each cycle.

**INFORMATION**

- ∅ 1. Selecting the proper level for the job to be done.

**TASK 28: EXPLAINING THE OPERATION OF THE AUTOMATIC WASHER TO THE  
CUSTOMER**

**COMMUNICATION**

- 1. Interpreting the instruction manual concerning the operation procedures of the automatic washer.
- 2. Explaining the selection of cycles.
- 3. Explaining the operation of accessories.
- ∅ 4. Explaining methods of protecting the finish of the washer.

**TASK 29: CONNECTING THE ELECTRICAL SUPPLY TO THE REFRIGERATOR IN THE HOME**

**SKILLS**

- \* 1. Plugging the electric line cord into the wall receptacle.

**TASK 30: CHECKING THE INSTALLATION OF THE REFRIGERATOR AND MAKING ANY FINAL ADJUSTMENTS NECESSARY**

**SKILLS**

- Ø 1. Leveling the refrigerator to insure proper door swing.
- 2. Setting the automatic defrost timers.
- 3. Setting the temperature controls on the refrigerator.

**TASK 31: EXPLAINING THE OPERATION OF THE REFRIGERATOR TO THE CUSTOMER**

**COMMUNICATION**

- 1. Interpreting instruction manual concerning operating procedures of the refrigerator.
- 2. Explaining the adjustments of the shelves.
- 3. Explaining defrosting procedures.
- Ø 4. Explaining the methods of protecting finish on the refrigerator.

**TASK 32: OBSERVING THE SYMPTOMS TO DETERMINE THE DEFECT(S) IN AN AUTOMATIC WASHER**

**COMMUNICATION**

- \* 1. Interpreting the customer's complaint as to the malfunction of the washing machine.

Ø 2. Writing the malfunctions of the appliance on a service ticket.

### SKILLS

1. Operating the automatic washer in order to observe the malfunction.
2. Visually inspecting for obvious defects in the automatic washer.
- \* 3. Visually inspecting for obvious defects in the cord & plug on the automatic washer.

### INFORMATION

Ø 1. Explaining the basic operation of the automatic washer.

## **TASK 33: DISASSEMBLING THE AUTOMATIC WASHER IN ORDER TO MAKE THE NECESSARY REPAIR(S)**

### COMMUNICATION

Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

### SKILLS

1. Removing various types of fastening devices using the appropriate tools.
2. Applying penetrating oil or other fluids for freeing screws and fasteners.

### INFORMATION

Δ 1. Selecting the proper type and size of:

a. Screwdrivers	f. Hammers
b. Pliers	g. Chisels
c. Wrenches	h. Punches
d. Cutters	

Ø 2. Selecting the proper type and size of puller for the job to be done:

- a. Wheel
- b. Gear
- c. Shock
- d. Seal
- e. Bearing
- f. Drive block
- g. Others

- Δ 3. Applying the proper care, maintenance & storage of tools.
- 4. Selecting the proper type of hammer when using shock pullers.
- Δ 5. Recognizing the proper methods of holding wrenches.
- Δ 6. Applying the proper methods of holding the work.
- Δ 7. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 8. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 9. Applying the proper procedures for cutting with diagonal cutters.
- Δ 10. Determining the proper methods of stripping wire.
- Δ 11. Recognizing the various types of fastening devices.
- Δ 12. Recognizing the various types and uses of washers.
- Δ 13. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 14. Recognizing the difference between right & left hand threads.
- 15. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations

- \* e. Properly grounding the appliance

**TASK 34: ISOLATING THE ELECTRICAL DEFECT(S) TO A PARTICULAR SECTION OF THE AUTOMATIC WASHER**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting instructions and information located on the data plate of the unit.
- \* 3. Reading the manufacturer's service reference chart for possible causes of trouble.
- 4. Interpreting meter readings to determine conditions of the components.

**MEASUREMENT**

- \* 1. Measuring voltage at the service outlet with a volt-meter to determine the amount of voltage for the appliance.
- \* 2. Measuring current at the service outlet with an amp-probe to determine the amount of current available for the appliance.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

**SCIENCE**

- \* 1. Explaining the electron theory of current flow in the appliance.

**SKILLS**

- Δ 1. Connecting electrical meters in the proper manner.
- \* 2. Inspecting the electrical components with the appropriate electrical meters to locate the defective section:
  - a. Controls
  - b. Ignition

- c. Solenoids
- d. Relays
- e. Protective devices
- f. Motors
- g. Wiring

- 3. Inspecting the water supply for leaks and correct pressure.
- Ø 4. Applying the proper methods of checking for electrical grounds.

### INFORMATION

- Ø 1. Recognizing the importance of checking for water leaks at all connections.
- Ø 2. Explaining the operation of the automatic washer.
- Ø 3. Recognizing the various parts of the automatic washer.
- \* 4. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 5. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 6. Applying the proper care, maintenance and storage of electrical meters.
- \* 7. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.
- 8. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

**TASK 35: ISOLATING THE MECHANICAL DEFECT(S) TO A PARTICULAR SECTION OF THE AUTOMATIC WASHER****COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

1. Inspecting the mechanical devices of the washer for defects:
  - a. Pulleys
  - b. Drive unit
  - c. Suspension
  - d. Clutches
  - e. Agitator
  - f. Overload devices
  - g. Pumps
2. Visually inspecting the appliance for oil or water leaks.
3. Inspecting the mechanical internal devices for defects:
  - a. Gears
  - b. Connecting rods
  - c. Drive shafts
4. Inspecting the washer cabinet for:
  - a. Broken welds
  - b. Rattles
  - c. Dents
  - d. Chipped paint
  - e. Other obvious defects

**INFORMATION**

1. Recognizing the various parts of the automatic washer.
- Φ 2. Recognizing the methods of water extraction:
  - a. With centrifugal force
  - b. Vacuum collapsed tubs
- Φ 3. Explaining the basic operation of the automatic washer.
- Φ 4. Recognizing the importance of checking for water leaks at all connections.

**TASK 36: ISOLATING THE DEFECT(S) TO A PARTICULAR COMPONENT OF THE AUTOMATIC WASHER**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting instructions and information located on the data plate of the unit.
- \* 3. Interpreting meter readings to determine the condition of the components.

**MEASUREMENT**

- ◊ 1. Measuring voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.
- ◊ 2. Measuring current at the service outlet with an Amp-probe to determine the amount of current available for the appliance.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

**SCIENCE**

- \* 1. Explaining the electron theory of current flow in the appliance.

**SKILLS**

- \* 1. Visually inspecting for obvious defects in the cord and plug on the appliance.
- \* 2. Inspecting the electrical components with the appropriate electrical meters to locate the defective component:
  - a. Timer
  - b. Motor
  - c. Pump
  - d. Solenoids
  - e. Relays
  - f. Wiring
  - g. Controls
  - h. Protective devices

- \* 3. Connecting electrical meters in the proper manner.
- 4. Inspecting the mechanical components of the washer for defects:
  - a. Belts and pulleys
  - b. Bearings
  - c. Door hinge, latch and spring
  - d. Clutches
  - e. Suspension

#### INFORMATION

- Ø 1. Recognizing the various parts of the automatic washer.
- \* 2. Recognizing the importance of proper connections when using the appropriate electrical meters.
- \* 3. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 4. Applying the proper care, maintenance and storage of electrical meters.
- \* 5. Determining the correct method of inspecting, checking calibrating electrical meters to known standards.

#### **TASK 37: REPLACING THE DEFECTIVE PART(S) OF THE AUTOMATIC WASHER**

#### COMMUNICATION

- Δ 1. Interpreting drawings, specification, manufacturer's catalogues, service manuals, schematics and handbooks.

#### MEASUREMENT

- \* 1. Measuring tolerances and clearances with feeler gauges.

#### MATHEMATICS

- Ø 1. Calculating torque required to tighten threaded fasteners.

SKILLS

- △ 1. Disconnecting all electrical connections to the defective parts with the appropriate tools.
- △ 2. Removing all mechanical fastenings to the defective part with the appropriate tools.
- △ 3. Installing the new part in the same position as the part just removed with the appropriate tools.
- △ 4. Replacing all mechanical fasteners using the appropriate tools.
- △ 5. Rewiring the electrical connections using the appropriate tools.
- △ 6. Applying lubricant on linkage & levers of the appliance.

INFORMATION

- ∅ 1. Selecting the proper lubricant necessary for the moving parts of the appliance.
- ∅ 2. Recognizing the various parts of the automatic washer.
- △ 3. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
  - f. Hammers
  - g. Chisels
  - h. Punches
- △ 4. Applying the proper care, maintenance and storage of tools.
- △ 5. Recognizing the proper methods of holding wrenches.
- △ 6. Applying the proper methods of holding the work.
- △ 7. Applying methods of holding pliers for pulling, pressing and twisting.
- △ 8. Recognizing the results of using pliers for removing nuts and bolts.
- △ 9. Applying the proper procedures for cutting with diagonal cutters.
- △ 10. Determining the proper methods of stripping wire.

- △ 11. Recognizing the various types of fastening devices.
- △ 12. Recognizing the various types, uses and characteristics of threaded fasteners.
- △ 13. Recognizing the various types and uses of washers.
- △ 14. Applying the proper methods of installing threaded fasteners.
- △ 15. Recognizing the difference between right and left hand threads.
- 16. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

#### **TASK 36: REPAIRING THE DEFECTIVE PART(S) OF THE AUTOMATIC WASHER**

##### **COMMUNICATION**

- △ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

##### **MEASUREMENT**

- \* 1. Measuring tolerances & clearances with feeler gauges.

##### **MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

##### **SCIENCE**

- \* 1. Explaining the characteristics of series and parallel circuits used in the appliances.

SKILLS

- \* 1. Eliminating the possible causes of defects until the particular defective section of the appliance is found.
- Δ 2. Repairing broken wires, replacing loose screws, cleaning or tightening switch contact with the appropriate tools.
- Δ 3. Disconnecting all electrical connections to the defective part with the appropriate tools.
- Δ 4. Removing all mechanical fastenings to the defective part with the appropriate tools.
- \* 5. Cleaning all dirty components with the appropriate cleaning agents or solvents.
- Δ 6. Rewiring the electrical connections using the appropriate tools.
- Δ 7. Replacing all mechanical fasteners using the appropriate tools.
- Δ 8. Applying lubricant on linkage & levers of the appliance.

INFORMATION

- ∅ 1. Recognizing the possibility of repairing the part in the washer.
- ∅ 2. Recognizing that repairs requiring extensive power tools should be done in the shop.
- \* 3. Recognizing the proper types of solvents and cleaning agents needed for cleaning parts.
- ∅ 4. Recognizing the various parts of the automatic washer.
- 5. Selecting the proper methods of repairing, replacement, and/or servicing electrical components and assemblies:
  - a. Timer motor and escapement
  - b. Water level control devices
  - c. Cover interlock switches
  - d. Mix and fill valves
  - e. Solenoids
  - f. Germicidal lamps and signals
  - g. Temperature control switches
  - h. Wiring
- 6. Selecting the proper methods of repairing, replacement and/or servicing mechanical components and assemblies:

- a. Tub and cabinet assembly
- b. Suspension assembly
- c. Cover and batching mechanism
- d. Water activating devices
- e. Detergent and bleach dispenser mechanism
- f. Drain and suds return pumps
- g. Inlet valves
- h. Speed change devices
- i. Drives, flexible shaft, couplings, belt and friction
- j. Brakes and clutches
- k. Laundry retaining devices
- l. Soil traps

7. Recognizing the various methods of water extraction:

- a. Centrifugal force
- b. Vacuum collapsed tubs

8. Recognizing the proper types, uses and methods of repairing pumps:

- a. Direct or friction drive
- b. Type of impellers
- c. Water directional devices
- d. Effects of foreign objects in pump

9. Applying the proper methods and procedures in repairing drive mechanisms:

- a. Importance of proper lubrication
- b. Installation and replacement of gears and bearing
- c. Techniques of adjusting gear mesh
- d. Methods of cutting and installing gaskets

10. Applying the proper methods of repairing motor:

- a. Changing rotation
- b. Determining speed

11. Recognizing the types, function and method of repair and/or replacement of timers, switches and overload devices.

∅ 12. Applying the proper methods and procedures for installing keys, springs, pins, and retaining rings.

Δ 13. Selecting the proper type and size of:

- a. Screwdrivers
- b. Pliers
- c. Wrenches
- d. Cutters
- e. Nutdrivers
- f. Hammers
- g. Punches

- △ 14. Applying the proper care, maintenance & storage of tools.
- △ 15. Recognizing the proper methods of holding wrenches.
- △ 16. Applying the proper methods of holding the work.
- △ 17. Applying methods of holding pliers for pulling, pressing and twisting.
- △ 18. Recognizing the results of using pliers for removing nuts and bolts.
- △ 19. Applying the proper procedures for cutting with diagonal cutters.
- △ 20. Determining the proper methods of stripping wire.
- △ 21. Recognizing the various types of fastening devices.
- △ 22. Recognizing the various types, uses and characteristics of threaded fasteners.
- △ 23. Recognizing the various types and uses of washers.
- △ 24. Applying the proper methods of installing threaded fasteners.
- △ 25. Recognizing the difference between right and left hand threads.
- △ 26. Explaining the importance of observing recommended procedures when tightening down plates, covers, and flanges.
- \* 27. Selecting the proper types of solution for cleaning components.
- \* 28. Selection of the proper types and size soldering irons.
- \* 29. Selection of the proper types of tips for soldering irons.
- \* 30. Recognizing the importance of tinning the tip of the soldering iron.
- \* 31. Determining the correct composition of solders to use on the appliance.
- \* 32. Recognizing the importance and purposes of flux when soldering.
- \* 33. Applying the proper method of transferring heat to work.
- \* 34. Selecting the correct solder and flux.
- 35. Selecting the proper method of applying solder.

36. Applying the proper safety precautions:

- \* a. Wearing safety shoes with non-conducting soles
- \* b. Removing jewelry & items of clothing containing metal fasteners
- \* c. Avoiding work situations where moisture is present
- \* d. Disconnecting the appliance from the power supply before starting repair operations
- \* e. Properly grounding the appliance
- \* f. Wearing protective clothing when working with cleaning agents & solvents
- \* g. Applying proper ventilating procedures when working with cleaning agents & solvents

**TASK 39: REASSEMBLING THE REPAIRED AUTOMATIC WASHER**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- Δ 1. Replacing screws and fasteners with the appropriate tools.
- \* 2. Cleaning all dirty components with recommended solvents, brush and/or compressed air.
- Δ 3. Replacing all cover plates with the appropriate tools.

**INFORMATION**

- Δ 1. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
  - f. Hammers
  - g. Punches

- Δ 2. Applying the proper care, maintenance & storage of tools.
- Δ 3. Recognizing the proper methods of holding wrenches.
- Δ 4. Applying the proper methods of holding the work.
- Δ 5. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 6. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 7. Applying the proper procedures for cutting with diagonal cutters.
- Δ 8. Determining the proper methods of stripping wire.
- ∅ 9. Explaining the importance of observing recommended procedures when tightening down plates, covers and flanges.
- Δ 10. Recognizing the various types of fastening devices.
- Δ 11. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 12. Recognizing the various types and uses of washers.
- Δ 13. Applying the proper methods of installing threaded fasteners.
- Δ 14. Recognizing the difference between right and left hand threads.
- 15. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

**TASK 40: TESTING THE OPERATION OF THE AUTOMATIC WASHER****SKILLS**

- Ø 1. Checking all connections and mountings after making repair or replacement.
- Ø 2. Observing operation of new or repaired part for proper function and for excessive vibration.

**INFORMATION**

- Ø 1. Recognizing that incorrect wiring may blow a fuse or burn up part.
- Ø 2. Recognizing that loose or incorrect mounting may cause breakage of parts.
- Ø 3. Explaining the basic operation of the automatic washer.

**TASK 41: MAKING ANY FINAL ADJUSTMENTS TO THE REPAIRED AUTOMATIC WASHER****SKILLS**

- 1. Adjusting the machine and the components found malfunctioning in testing the operation for optimum performance.

**INFORMATION**

- Ø 1. Explaining the basic operation of the automatic washer.

**TASK 42: RETESTING THE ASSEMBLED AUTOMATIC WASHER****COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- 1. Operating manually the controls to start the appliance.

2. Observing the operation of the washer through complete cycles, noting accuracy of the timing mechanism.

#### INFORMATION

- φ 1. Explaining the basic operation of the automatic washer.

#### **TASK 43: OBSERVING THE SYMPTOMS TO DETERMINE THE DEFECT(S) IN AN ELECTRIC DRYER**

#### COMMUNICATION

- \* 1. Interpreting the customers complaint as to the malfunction of the automatic electric dryer.
- φ 2. Writing the malfunction of the appliance on a service ticket.

#### SKILLS

1. Operating the automatic electric dryer in order to observe the malfunction.
2. Visually inspecting the appliance for obvious defects.
- \* 3. Visually inspecting for obvious defects in the cord & plug on the appliance.
4. Analyzing the causes of poor drying:
  - a. Humidity
  - b. Venting
  - c. Moisture

#### INFORMATION

- φ 1. Explaining the basic operation of the electric dryer.

#### **TASK 44: ISOLATING THE ELECTRICAL DEFECT(S) TO A PARTICULAR SECTION OF THE AUTOMATIC ELECTRIC DRYER**

#### COMMUNICATION

1. Interpreting drawings, specifications, manufacturer's

catalogues, service manuals, schematics and handbooks.

- \* 2. Reading the manufacturer's service reference charts for possible causes of trouble.
- \* 3. Interpreting meter readings to determine the condition of the components.

#### MEASUREMENT

- Ø 1. Measuring voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.
- Ø 2. Measuring the current at the service outlet with an Amp-probe to determine the amount of current available for the appliance.

#### MATHEMATICS

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

#### SCIENCE

- \* 1. Explaining the electron theory of current flow in the appliance.

#### SKILLS

- \* 1. Connecting electrical meters in the proper manner.
- \* 2. Inspecting the electrical components with the appropriate electrical meters to locate the defective section:
  - a. Controls
  - b. Ignition
  - c. Solenoids
  - d. Relays
  - e. Protective devices
  - f. Motors
  - g. Wiring
- \* 3. Inspecting the electrical devices and eliminating the possible causes until the particular defective section is found.
- Ø 4. Inspecting the temperature setting devices with a pyrometer.

INFORMATION

- Ø 1. Recognizing the various parts of the electric dryer.
- Ø 2. Explaining the basic operation of the electric dryer.
- \* 3. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 4. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 5. Applying the proper care, maintenance and storage of electrical meters.
- \* 6. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.
- 7. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

**TASK 45: ISOLATING THE MECHANICAL DEFECT(S) TO A PARTICULAR SECTION OF THE AUTOMATIC ELECTRIC DRYER**COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Reading the manufacturer's service reference charts for possible causes of trouble.

SKILLS

1. Inspecting the dryer for proper motor operation.
2. Inspecting the air circulation system for proper operation.
3. Inspecting the cabinet or tub of the dryer for rattles.

INFORMATION

- ◊ 1. Recognizing the various parts of the electric dryer.
- ◊ 2. Applying the proper procedure for diagnosing the malfunctions or incorrect operation.

**TASK 46: DISASSEMBLING THE AUTOMATIC ELECTRIC DRYER IN ORDER TO MAKE THE NECESSARY REPAIR(S)**COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

SKILLS

- Δ 1. Removing the various types of fastening devices using the appropriate tools.
- ◊ 2. Applying penetrating oil or other fluids for freeing screws and fasteners.

INFORMATION

- ◊ 1. Recognizing the various parts of the electric dryer.
- Δ 2. Selecting the proper types and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
  - f. Hammers
  - g. Chisels
  - h. Punches
  - i. Pullers

- △ 3. Applying the proper care, maintenance & storage of tools.
- △ 4. Recognizing the proper methods of holding wrenches.
- △ 5. Applying the proper methods of holding the work.
- △ 6. Applying methods of holding pliers for pulling, pressing and twisting.
- △ 7. Recognizing the results of using pliers for removing nuts and bolts.
- △ 8. Applying the proper procedures for cutting with diagonal cutters.
- △ 9. Determining the proper methods of stripping wire.
- △ 10. Recognizing the mechanical advantage of wrenches.
- △ 11. Recognizing the importance of correct fit of wrenches on head of bolts and nuts.
- \* 12. Selecting the proper type of punches for the job to be done.
- \* 13. Selecting the proper type of hammer for the job to be done.
- \* 14. Selecting the proper type of hammer when using shock pullers.
- \* 15. Selecting the proper type of puller for the job to be done.
- \* 16. Selecting the proper type of chisel for the job to be done.
- △ 17. Recognizing the various types of fastening devices.
- △ 18. Recognizing the various types, uses and characteristics of threaded fasteners.
- △ 19. Recognizing the various types and uses of washers.
- △ 20. Applying the proper methods of installing threaded fasteners.
- △ 21. Recognizing the difference between right and left hand threads.
- \* 22. Selection of the proper types and size soldering irons.
- \* 23. Selection of the proper types of tips for soldering irons.
- \* 24. Recognizing the importance of tinning the tip of the soldering iron.

- \* 25. Determining the correct composition of solders to use on the appliance.
- \* 26. Recognizing the importance and purposes of flux when soldering.
- \* 27. Applying the proper method of transferring heat to work.
- \* 28. Selecting the correct solder and flux.
- \* 29. Selecting the proper method of applying solder.
- 30. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

**TASK 47: ISOLATING THE DEFECT(S) TO A PARTICULAR COMPONENT OF THE ELECTRIC DRYER**

**COMMUNICATION**

- \* 1. Interpreting drawings, specification, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting instructions and information located on the data plate of the unit.
- \* 3. Interpreting meter readings to determine the condition or the components.

**MEASUREMENT**

- Ø 1. Measuring voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.
- Ø 2. Measuring current at the service outlet with an Amp-probe to determine the amount of current available for the appliance.

MATHEMATICS

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

SCIENCE

- \* 1. Explaining the electron theory of current flow in the appliance.

SKILLS

- \* 1. Visually inspecting for obvious defects in the cord and plug or electrical connection on the electric dryer.
- \* 2. Inspecting the electrical components with the appropriate electrical meters to locate the defective component:
  - a. Timer
  - b. Motor
  - c. Solenoids
  - d. Relays
  - e. Wiring
  - f. Controls
  - g. Protective devices
- \* 3. Connecting electrical meters in the proper manner.
- 4. Inspecting mechanical components of the dryer for defects:
  - a. Belts and pulleys
  - b. Bearings
  - c. Door hinge, latch and spring

INFORMATION

- \* 1. Recognizing the various parts of the electric dryer.
- \* 2. Recognizing the importance of proper connections when using the appropriate electrical meters.
- \* 3. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 4. Applying the proper care, maintenance and storage of electrical meters.

- \* 5. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.
- ◊ 6. Apply the proper procedure for tracing electrical circuits.

**TASK 48: REPLACING THE DEFECTIVE PART(S) OF THE AUTOMATIC ELECTRIC DRYER**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.
- 2. Calculating the torque required to tighten threaded fasteners.

**SCIENCE**

- \* 1. Explaining the electron theory of current flow in the appliance.
- \* 2. Explaining the characteristics of series and parallel circuits used in the appliance.

**SKILLS**

- Δ 1. Disconnecting all electrical connections to the defective parts using the appropriate tools.
- Δ 2. Removing all mechanical fastenings to the defective parts using the appropriate tools.
- Δ 3. Installing the new part in the same position as the part just removed with the appropriate tools.
- Δ 4. Replacing all mechanical fasteners with appropriate tools.
- Δ 5. Rewiring all electrical connections with the appropriate tools.
- Δ 6. Applying lubricant on linkage & levers of the appliance.

INFORMATION

- △ 1. Recognizing the various parts of the electric dryer.
- 2. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

**TASK 49: REPAIRING THE DEFECTIVE PART(S) OF THE AUTOMATIC ELECTRIC DRYER**COMMUNICATION

- △ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

MEASUREMENT

- 1. Measuring tolerances & clearances with feeler gauge.

MATHEMATICS

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

SCIENCE

- \* 1. Explaining the characteristics of series and parallel circuit.

SKILLS

- \* 1. Eliminating the possible causes of defects until the particular defective section of the appliance is found.
- △ 2. Disconnecting all electrical connections to the defective parts with the appropriate tools.

- △ 3. Repairing broken wires, replacing loose screws, cleaning and tightening switch contacts with the appropriate tools.
- △ 4. Removing all mechanical fastenings from the defective part with the appropriate tools.
- \* 5. Cleaning dirty components using the appropriate cleaning agents & solutions.
- △ 6. Rewiring the electrical connections with the appropriate tools.
- △ 7. Replacing all mechanical fasteners with the appropriate tools.
- \* 8. Applying lubricant on linkage & levers of the appliance.
- ∅ 9. Applying penetrating oil or other fluids for freeing screws and fasteners.

#### INFORMATION

- ∅ 1. Recognizing the possibility of repairing the part in the dryer.
- ∅ 2. Recognizing that repairs requiring extensive power tools should be done in the shop.
- \* 3. Recognizing the proper types of solvents and cleaning agents needed for cleaning parts.
- ∅ 4. Recognizing the various parts of the electric dryer.
- ∅ 5. Selecting the proper lubricant necessary for the moving parts of the electric dryer.
- ∅ 6. Selecting the proper methods of repairing, replacement and/or servicing electrical components and assemblies.
- ∅ 7. Selecting the proper methods of repairing, replacement and/or servicing mechanical components and assemblies.
- 8. Applying the proper methods and procedures in repairing drive mechanisms.
- 9. Applying the proper methods of repairing motor:
  - a. Changing rotation
  - b. Determining speed
- 10. Recognizing the types, function and method of repair and/or replacement of timers, switches and overload devices.

- ◊ 11. Applying the proper methods and procedures for installing keys, springs, pins, and retaining rings.
- Δ 12. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
  - f. Hammers
  - g. Chisels
  - h. Punches
  - i. Pullers
- Δ 13. Applying the proper care, maintenance & storage of tools.
- Δ 14. Recognizing the proper methods of holding wrenches.
- Δ 15. Applying the proper methods of holding the work.
- Δ 16. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 17. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 18. Applying the proper procedures for cutting with diagonal cutters.
- Δ 19. Determining the proper methods of stripping wires.
- ◊ 20. Explaining the importance of observing recommended procedures when tightening down plates, covers, and flanges.
- Δ 21. Recognizing the various types of fastening devices.
- Δ 22. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 23. Recognizing the various types and uses of washers.
- Δ 24. Applying the proper methods of installing threaded fasteners.
- Δ 25. Recognizing the difference between right and left hand threads.

## TASK 50: REASSEMBLING THE REPAIRED AUTOMATIC ELECTRIC DRYER

COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- Δ 2. Replacing fasteners & cover plate with the appropriate tools.

SKILLS

- 1. Replacing screws and fasteners using the appropriate tools.
- \* 2. Cleaning all dirty components with recommended solvents, brush and/or compressed air.

INFORMATION

- Δ 1. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
  - f. Hammers
  - g. Chisels
  - h. Punches
  - i. Pullers
- Δ 2. Applying the proper care, maintenance & storage of tools.
- Δ 3. Recognizing the proper methods of holding wrenches.
- Δ 4. Applying the proper methods of holding the work.
- Δ 5. Applying methods of holding pliers for pulling, pressing, and twisting.
- Δ 6. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 7. Applying the proper procedures for cutting with diagonal cutters.
- Δ 8. Determining the proper methods of stripping wire.
- Δ 9. Recognizing the various types of fastening devices.
- Δ 10. Recognizing the various types, uses and characteristics of threaded fasteners.

- Δ 11. Recognizing the various types and uses of washers.
- Δ 12. Applying the proper methods of installing threaded fasteners.
- Δ 13. Recognizing the difference between right and left hand threads.
- 14. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

#### **TASK 51: TESTING THE OPERATION OF THE AUTOMATIC ELECTRIC DRYER**

##### **SKILLS**

1. Checking all connections and mountings after making repair or replacement.
2. Testing repair by actual operation of the part.
3. Observing operation of new or repaired part for proper function and for excessive vibration.

##### **INFORMATION**

- ∅ 1. Recognizing that incorrect wiring may blow fuse or burn up part.
- ∅ 2. Recognizing that loose or incorrect mounting may cause breakage.
- ∅ 3. Explaining the basic operation of the electric dryer.

4. Explaining the effects of incorrect temperature on:

- a. Drying time
- b. Fabrics and fibers

**TASK 52: MAKING ANY FINAL ADJUSTMENTS TO THE REPAIRED AUTOMATIC ELECTRIC DRYER**

**SKILLS**

- 1. Adjusting the machine and the components found malfunctioning in testing the operation for optimum performance.

**TASK 53: RETESTING THE ASSEMBLED AUTOMATIC ELECTRIC DRYER**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- ∅ 1. Operating manually the controls to start the electric automatic dryer.
- 2. Observing the operation of the dryer through complete cycles, noting accuracy of the timing mechanism.

**INFORMATION**

- ∅ 1. Explaining the basic operation of the electric dryer.

**TASK 54: OBSERVING THE SYMPTOMS TO DETERMINE THE DEFECT(S) IN A REFRIGERATOR**

**COMMUNICATION**

- \* 1. Interpreting the customer's complaint to malfunction of the refrigerator.

- Ø 2. Writing the malfunction of the appliance on a service ticket.

### SKILLS

- 1. Visually inspecting the appliance for obvious defects.

### INFORMATION

- Ø 1. Explaining the basic operation of the refrigerator.

## **TASK 55: DISASSEMBLING THE REFRIGERATOR IN ORDER TO MAKE THE NECESSARY REPAIR(S)**

### COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

### SKILLS

- Δ 1. Removing cover plates with a screwdriver to expose compressor.

### INFORMATION

- Δ 1. Recognizing the various parts of the refrigerator.
- Δ 2. Selecting the proper type and size of screwdrivers.
- Δ 3. Recognizing the various types of fastening devices.
- Δ 4. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 5. Recognizing the various types and uses of washers.
- Δ 6. Applying the proper methods of installing threaded fasteners.
- Δ 7. Recognizing the difference between right and left hand threads.

8. Applying the proper safety precautions:

- \* a. Wearing safety shoes with non-conducting soles
- \* b. Removing jewelry & items of clothing containing metal fasteners
- \* c. Avoiding work situations where moisture is present
- \* d. Disconnecting the appliance from the power supply before starting repair operations

**TASK 56: ISOLATING THE ELECTRICAL DEFECT(S) TO A PARTICULAR SECTION OF THE REFRIGERATOR**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting instructions and information located on the data plate of the unit.
- ∅ 3. Reading the manufacturer's service reference charts for possible causes of trouble.
- \* 4. Interpreting meter readings to determine the condition of the components.

**MEASUREMENT**

- ∅ 1. Measuring voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.
- ∅ 2. Measuring current at the service outlet with an Amp-probe to determine the amount of current available for the appliance.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

**SCIENCE**

- \* 1. Explaining the electron theory of current flow in the appliance.

SKILLS

- \* 1. Inspecting the home electrical supply with the appropriate electrical meters.
- \* 2. Inspecting the electrical system of the appliances with the appropriate electrical meters:
  - a. Controls
  - b. Motor
  - c. Compressor
  - d. Wiring
  - e. Capacitor
- \* 3. Inspecting the electrical components with the appropriate electrical meters to locate the defective section.
- \* 4. Connecting electrical meters in the proper manner.

INFORMATION

- Ø 1. Applying the proper procedure for tracing electrical circuits.
- Ø 2. Applying the proper procedure for diagnosing malfunctions or improper operation.
- \* 3. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 4. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 5. Applying the proper care, maintenance, & storage of electrical meters.
- \* 6. Determining the correct method of inspecting, checking calibrating electrical meters to known standards.

**TASK 57: ISOLATING THE MECHANICAL DEFECT(S) TO A PARTICULAR SECTION OF THE REFRIGERATOR**

COMMUNICATION

- A 1. Interpreting drawings, specifications, manufacturer's

catalogues, service manuals, schematics and handbooks.

- Ø 2. Reading the manufacturer's service reference charts for possible causes of trouble.

#### MEASUREMENT

- \* 1. Measuring refrigerant in the system with a pressure gauge.

#### SKILLS

- 1. Visually inspecting the refrigerant tubing for damage or wear (kinks, nicks, or breaks).
- 2. Checking the temperature inside the refrigerator with a recording thermometer.
- 3. Inspecting the door gasket seal for tightness.
- \* 4. Inspecting the refrigerant tubing for leaks with a Hallide leak detector.

#### INFORMATION

- Ø 1. Applying the proper procedure for diagnosing malfunctions or improper operation.
- 2. Applying the proper methods of using Hallide leak detector and interpreting the results.

### **TASK 58: ISOLATING THE DEFECT(S) TO A PARTICULAR COMPONENT IN A REFRIGERATOR**

#### COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting instructions and information located on the data plate of the unit.
- \* 3. Interpreting meter readings to determine the condition of the components.
- \* 4. Interpreting gauges to determine the depth and duration of vacuum as indicated in specifications.

MEASUREMENT

- ◊ 1. Measuring the voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.
- ◊ 2. Measuring the current at the service outlet with an Amp-probe to determine the amount of current available for the appliance.
- \* 3. Measuring the refrigerant in the system with a pressure gauge.

MATHEMATICS

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.
- 2. Calculating the amount of refrigerant needed in the lines.

SCIENCE

- \* 1. Explaining the electron theory of current flow in the appliance.
- \* 2. Explaining the characteristics of series and parallel circuits used in the appliance.

SKILLS

- \* 1. Inspecting the refrigerant tubing for leaks with a Hallide leak detector.
- ◊ 2. Applying the proper procedures for tracing the refrigerant flow.
- \* 3. Visually inspecting for obvious defects in the cord and plug or electrical connection on the appliance.
- \* 4. Applying the proper procedures of tracing electrical circuits.
- \* 5. Connecting electrical meters in the proper manner.
- \* 6. Inspecting the electrical components with the appropriate electrical meters to locate the defective component.

INFORMATION

- ◊ 1. Recognizing the various parts of the refrigerator.

- \* 2. Recognizing the importance of proper connections when using the appropriate electrical meters.
- \* 3. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 4. Applying the proper care, maintenance & storage of electrical meters.
- \* 5. Determining the correct method of inspecting, checking calibrating electrical meters to known standards.

#### **TASK 59: REPLACING THE DEFECTIVE PART(S) OF THE REFRIGERATOR**

##### **COMMUNICATION**

- 4 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting gauges to determine the depth and duration of vacuum as indicated in specifications.

##### **MEASUREMENT**

- \* 1. Measuring refrigerant in system with a pressure gauge.

##### **MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.
- 2. Calculating the amount of refrigerant required to charge the system.

##### **SKILLS**

- Ø 1. Charging the refrigerator systems with the specified refrigerant.

¶ 2. Applying the proper procedures for replacing the following in the appliance with the appropriate tools:

- a. Capacitor
- b. Drier
- c. Compressor
- d. Solenoid
- e. Door gasket
- f. Broken tubing

#### INFORMATION

\* 1. Recognizing the different types of refrigerants used in refrigerators.

\* 2. Explaining the effects of contaminants in the system:

- a. Mercury
- b. Moisture
- c. Non-condensable gasses
- d. Dirt

Δ 3. Selecting the proper type and size of:

- a. Screwdrivers
- b. Pliers
- c. Wrenches
- d. Cutters
- e. Nutdrivers

Δ 4. Applying the proper care, maintenance and storage of tools.

Δ 5. Recognizing the proper methods of holding wrenches.

Δ 6. Applying the proper methods of holding the work.

Δ 7. Applying methods of holding pliers for pulling, pressing and twisting.

Δ 8. Recognizing the results of using pliers for removing nuts and bolts.

Δ 9. Applying the proper procedures for cutting with diagonal cutters.

Δ 10. Determining the proper methods of stripping wire.

Δ 11. Recognizing the various types of fastening devices.

Δ 12. Recognizing the various types, uses and characteristics of threaded fasteners.

Δ 13. Recognizing the various types and uses of washers.

- ▲ 14. Applying the proper methods of installing threaded fasteners.
- ▲ 15. Recognizing the difference between right and left hand threads.
- 16. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

#### **TASK 60: REPAIRING THE DEFECTIVE PART(S) OF THE REFRIGERATOR**

##### **COMMUNICATION**

- ▲ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

##### **MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

##### **SCIENCE**

- \* 1. Explaining the characteristics of series and parallel circuits used in the appliance.

##### **SKILLS**

- 1. Demonstrating the procedure of using vacuum pumps to remove contaminants in the system.

INFORMATION

- \* 1. Explaining the effects in the system of:
  - a. Mercury
  - b. Moisture
  - c. Non-condensable gasses
  - d. Dirt
- Δ 2. Applying the proper care, maintenance & storage of tools.
- \* 3. Applying the proper safety precautions when working with refrigerants.

**TASK 61: REASSEMBLING THE REPAIRED REFRIGERATOR**COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

SKILLS

- 1. Removing all gauges & manifolds from the system.
- Δ 2. Replacing cover plates with a screwdriver.

INFORMATION

- Δ 1. Selecting the proper type and size of screwdrivers.
- Δ 2. Applying the proper care, maintenance & storage of tools.
- Δ 3. Recognizing the various types of fastening devices.
- Δ 4. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 5. Recognizing the various types and uses of washers.
- Δ 6. Applying the proper methods of installing threaded fasteners.
- Δ 7. Recognizing the difference between right and left hand threads.

8. Applying the proper safety precautions:

- \* a. Wearing safety shoes with non-conducting soles
- \* b. Removing jewelry & items of clothing containing metal fasteners
- \* c. Avoiding work situations where moisture is present
- \* d. Disconnecting the appliance from the power supply before starting repair operations

**TASK 62: TESTING THE OPERATION OF THE REFRIGERATOR**

**SKILLS**

1. Checking all connections and mountings after making repairs for leaks.
2. Testing repairs by actual operation of the refrigerator.
3. Observing operation of new or repaired part for proper function.
4. Testing temperature control for performance.

**INFORMATION**

- Ø 1. Explaining the basic operation of the refrigerator.

**TASK 63: MAKING ANY FINAL ADJUSTMENTS TO THE REPAIRED REFRIGERATOR**

**SKILLS**

1. Adjusting the temperature control knob to weather conditions.

**TASK 64: RETESTING THE ASSEMBLED REFRIGERATOR****COMMUNICATION**

1. Reading the recording from the thermometer to determine performance.

**MEASUREMENT**

1. Measuring the temperature cycling intervals.

**SKILLS**

1. Operating the repaired refrigerator for 72 hours with a recording thermometer attached.

**INFORMATION**

1. Testing in a quiet room in order to check for noise.

**TASK 65: OBSERVING THE SYMPTOMS TO DETERMINE THE DEFECT(S) IN AN ELECTRIC RANGE****COMMUNICATION**

- \* 1. Interpreting the customer's complaint as to the malfunction of the electric range.
- Ø 2. Writing the malfunction of the appliance on a service ticket.

**SKILLS**

1. Operating the appliance in order to observe the malfunction.
2. Visually inspecting the appliance for obvious defects.
- \* 3. Visually inspecting for obvious defects in the cord & plug on the appliance.

**INFORMATION**

- Ø 1. Explaining the basic operation of the electric range.

**TASK 66: ISOLATING THE ELECTRICAL DEFECT(S) TO A PARTICULAR SECTION OF THE ELECTRIC RANGE****COMMUNICATION**

- ▲ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Interpreting instructions and information located on the data plate of the unit.
- \* 3. Reading the manufacturer's service reference charts for possible causes of trouble.
- \* 4. Interpreting meter readings to determine the condition of the components.

**MEASUREMENT**

- \* 1. Measuring voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.
- \* 2. Measuring current at the service outlet with an Amp-probe to determine the amount of current available for the appliance.

**MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

**SCIENCE**

- \* 1. Explaining the electron theory of current flow in the appliance.

**SKILLS**

1. Inspecting the electrical system of the appliance for defects:
  - a. Elements
  - b. Heat controls
  - c. Switches
  - d. Electrical system
  - e. Timing devices

- \* 2. Inspecting the electrical components with the appropriate electrical meters to locate the defective section.
- \* 3. Connecting electrical meters in the proper manner.

#### INFORMATION

- ◊ 1. Explaining the importance of checking for electrical grounds.
- ◊ 2. Applying the proper procedure for tracing electrical circuits.
- ◊ 3. Applying the proper procedure for diagnosing malfunctions or improper operation.
- \* 4. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 5. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 6. Applying the proper care maintenance & storage of electrical meters.
- \* 7. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.

#### **TASK 67: DISASSEMBLING THE ELECTRIC RANGE IN ORDER TO MAKE THE NECESSARY REPAIR(S)**

#### COMMUNICATION

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

#### SKILLS

- Δ 1. Removing the heating elements from the electric range with the appropriate tools.
- Δ 2. Removing the oven case and/or side panels with the appropriate tools.

- △ 3. Removing oven door with the appropriate tools.
- △ 4. Removing various types of fasteners in the electric range with the appropriate tools.
- △ 5. Removing cover panels necessary to make repairs with a screwdriver.
- 6. Disconnecting home power before attempting repairs on the electric range.
- 7. Removing table top range unit from built in cabinet using the appropriate tools.

#### INFORMATION

- △ 1. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- △ 2. Applying the proper care, maintenance & storage of tools.
- △ 3. Recognizing the proper methods of holding wrenches.
- △ 4. Applying methods of holding pliers for pulling, pressing and twisting.
- △ 5. Recognizing the results of using pliers for removing nuts and bolts.
- △ 6. Applying the proper procedures for cutting with diagonal cutters.
- △ 7. Determining the proper methods of stripping wire.
- △ 8. Recognizing the various types of fastening devices.
- △ 9. Recognizing the various types, uses and characteristics of threaded fasteners.
- △ 10. Recognizing the various types and uses of washers.
- △ 11. Applying the proper methods of installing threaded fasteners.
- △ 12. Recognizing the difference between right and left hand threads.

**13. Applying the proper safety precautions:**

- \* a. Wearing safety shoes with non-conducting soles
- \* b. Removing jewelry & items of clothing containing metal fasteners
- \* c. Avoiding work situations where moisture is present
- \* d. Disconnecting the appliance from the power supply before starting repair operations
- \* e. Properly grounding the appliance

**TASK 68: ISOLATING THE MACHANICAL DEFECT(S) TO A PARTICULAR SECTION OF THE ELECTRIC RANGE**

**COMMUNICATION**

- A 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- \* 2. Reading the manufacturer's service reference charts for possible causes of trouble.

**SKILLS**

1. Inspecting the hinges and counterbalances on doors of the appliance.
2. Inspecting rotisseries and special broiling accessories of the appliance.

**INFORMATION**

1. Applying the proper procedure for diagnosing malfunctions or improper operation.

**TASK 69: ISOLATING THE DEFECT(S) TO A PARTICULAR COMPONENT IN AN ELECTRIC RANGE**

**COMMUNICATION**

- A 1. Interpreting drawings, specifications, manufacturer's

catalogues, service manuals, schematics and handbooks.

- \* 2. Reading the manufacturer's service reference charts for possible causes of trouble.
- \* 3. Interpreting meter readings to determine the condition of the components.

#### MATHEMATICS

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

#### SCIENCE

- \* 1. Explaining the electron theory of current flow in the appliance.

#### SKILLS

- ▲ 1. Inspecting the electrical components with a continuity tester or the appropriate electrical meter:

- a. Elements
- b. Heat controls
- c. Switches
- d. Timing devices
- e. Wiring
- f. Automatic controls

- 2. Inspecting for grounds or short circuits in the appliance.
- 3. Inspecting for defective oven or panel lights.
- \* 4. Connecting electrical meters in the proper manner.
- ▲ 5. Visually inspecting for obvious defects in the cord and plug on the appliance.

#### INFORMATION

- 1. Selecting the proper method of obtaining various heat ranges.

2. Recognizing the types, purposes, and function of switches:

- a. Rotary
- b. Push button
- c. Multi-heat
- d. Micro
- e. Interlock

Ø 3. Applying the proper procedure for tracing electrical circuits.

4. Recognizing the types, purposes and functions of automatic controls used in electric ranges:

- a. Hydraulic
- b. Bi-metallic
- c. Thermistors
- d. Time clocks
- e. Minute minders
- f. Pneumatic

5. Applying the proper method of checking and adjusting temperatures.

6. Recognizing the types, purposes, function and servicing of lights used in electric ranges:

- a. Oven lights
- b. Cooking top lights-incandescent, fluorescent
- c. Signal lights
- d. Methods of lowering voltage for low-voltage pilot lights

7. Recognizing the types of hinges and counter-balances on doors and the:

- a. Importance of lubrication on rollers and pivots
- b. Effects of improper spring tension

Ø 8. Recognizing the various parts of the electrical range.

\* 9. Recognizing the importance of proper connection of appropriate electrical meters.

\* 10. Selecting the appropriate electrical meters for the job to be done:

- a. Voltmeter
- b. Amp-meter or Amp-probe
- c. Continuity tester
- d. Volt-Ohm meter

- \* 11. Applying the proper care, maintenance and storage of electrical meters.
- \* 12. Determining the correct method of inspecting, checking calibrating electrical meters to known standards.

## **TASK 70: REPLACING THE DEFECTIVE PART(S) OF THE ELECTRIC RANGE**

### **COMMUNICATION**

- △ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

### **MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

### **SCIENCE**

- \* 1. Explaining the characteristics of series and parallel circuits used in the appliance.

### **SKILLS**

- △ 1. Applying the proper types of lubricants where needed in the electric range.
- △ 2. Replacing the gasket around the oven unit with a screwdriver.
- △ 3. Disconnecting all electrical connections to the defective part with a screwdriver.
- △ 4. Removing all mechanical fasteners with the appropriate tools.
- △ 5. Installing new part with the appropriate tools.
- △ 6. Replacing various types of lights found in electric ranges.
- △ 7. Rewiring all electrical connections using the appropriate tools.
- △ 8. Replacing oven door windows using the appropriate tools.

INFORMATION

- ◊ 1. Selecting the proper lubricant necessary for the moving parts of the electric range.
- Δ 2. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
  - f. Levels
- Δ 3. Applying the proper care, maintenance & storage of tools.
- Δ 4. Recognizing the proper methods of holding wrenches.
- Δ 5. Applying the proper method for holding work.
- Δ 6. Applying method of holding pliers for pulling, pressing and twisting.
- Δ 7. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 8. Applying the proper procedures for cutting with diagonal cutters.
- Δ 9. Determining the proper methods of stripping wire.
- Δ 10. Recognizing the various types of fastening devices.
- Δ 11. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 12. Recognizing the various types and uses of washers.
- Δ 13. Applying the proper methods of installing threaded fasteners.
- Δ 14. Recognizing the difference between right and left hand threads.
- 15. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply

before starting repair operations

- \* e. Properly grounding the appliance

### **TASK 71: REPAIRING THE DEFECTIVE PART(S) OF THE ELECTRIC RANGE**

#### **COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

#### **MATHEMATICS**

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

#### **SCIENCE**

- \* 1. Explaining the characteristics of series & parallel circuits in the appliance.

#### **SKILLS**

- Δ 1. Repairing hinges and counter-balances on doors:
  - a. Adjustments to frame of door
  - b. Adjustments to hinge of door
- Ø 2. Rewiring the oven unit with the appropriate tools.
- Δ 3. Repairing broken wires with solderless connection and crimping tool.
- Δ 4. Cleaning the tightening switch contacts with abrasive cloth and a screwdriver.
- Δ 5. Rewiring all electrical connections with the appropriate tools.
- Δ 6. Removing mechanical fasteners with the appropriate tools.
- 7. Removing defective part with the appropriate tools.
- 8. Installing and mounting the repaired part with the appropriate tools.
- 9. Applying lubricant on linkage and levers of the appliance.

INFROMATION

- Δ 1. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
- Δ 2. Applying the proper care, maintenance & storage of tools.
- Δ 3. Recognizing the proper methods of holding wrenches.
- Δ 4. Applying the proper methods of holding the work.
- Δ 5. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 6. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 7. Applying the proper procedures for cutting with diagonal cutters.
- Δ 8. Determining the proper methods of stripping wire.
- Δ 9. Recognizing the various types of fastening devices.
- Δ 10. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 11. Recognizing the various types and uses of washers.
- Δ 12. Applying the proper methods of installing threaded fasteners.
- Δ 13. Recognizing the difference between right and left hand threads.
- ∅ 14. Recognizing the various parts of the electric range.
- 15. Recognizing the importance and method of proper connection of elements.
- 16. Applying the proper method of checking and adjusting temperatures.
- ∅ 17. Selecting the proper lubricant necessary for the moving parts of the electric range.
- 18. Recognizing the importance of correct temperatures.

**TASK 72: REASSEMBLING THE REPAIRED ELECTRIC RANGE****COMMUNICATION**

Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

- ∅ 1. Cleaning all dirty components with a small brush.
- Δ 2. Replacing all components and fasteners with the appropriate tools.
- Δ 3. Replacing all cover plates with the appropriate tools.
- ∅ 4. Cleaning terminals for good contact with abrasive cloth.

**INFORMATION**

- Δ 1. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Wrenches
  - d. Cutters
  - e. Nutdrivers
  - f. Levels
- Δ 2. Applying the proper care, maintenance & storage of tools.
- Δ 3. Recognizing the proper methods of holding wrenches.
- Δ 4. Applying the proper methods of holding the work.
- Δ 5. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 6. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 7. Applying the proper procedures for cutting with diagonal cutters.
- Δ 8. Determining the proper methods of stripping wire.
- Δ 9. Recognizing the various types of fastening devices.
- Δ 10. Recognizing the various types, uses and characteristics of threaded fasteners.

- ▲ 11. Recognizing the various types and uses of washers.
- ▲ 12. Applying the proper methods of installing threaded fasteners.
- ▲ 13. Recognizing the difference between right and left hand threads.
- 14. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the appliance from the power supply before starting repair operations
  - \* e. Properly grounding the appliance

#### **TASK 73: TESTING THE OPERATION OF THE ELECTRIC RANGE**

##### **SKILLS**

- 1. Checking all connections and mountings after making repair or replacement.
- 2. Observing operation of new or repaired part for proper function.
- Ø 3. Testing a selected temperature range with a pyrometer.

##### **INFORMATION**

- 1. Recognizing the importance of proper connections of heating elements.

#### **TASK 74: MAKING ANY FINAL ADJUSTMENTS TO THE REPAIRED ELECTRIC RANGE**

##### **SKILLS**

- 1. Adjusting the appliance and components for optimum performance.

Δ 2. Adjusting oven doors for proper closure with the appropriate tools.

INFORMATION

1. Explaining the results of improper rack adjustments:
  - a. In baking
  - b. In broiling

**TASK 75: RETESTING THE ASSEMBLED ELECTRIC RANGE**

SKILLS

1. Operating the controls to the various units of the electric range manually.
- Ø 2. Explaining the basic operation of the electric range.

**RADIO AND TELEVISION SERVICING**

**TASK 1: OBSERVING THE SYMPTOMS TO DETERMINE THE DEFECTIVE STAGE OF THE RADIO**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks:
  - a. Installation procedures and techniques
  - b. Service procedures
  - c. Type, function and rating of defective part
  - d. Electrical supplies
  - e. Repair and replacement of components
  - f. Special service tools
  - g. Electrical codes
- 2. Reading block diagram to follow stages in the radio.
- 3. Locating the different stages of the radio from the schematic diagram.

**SCIENCE**

- 1. Explaining the characteristics and function of radio waves.

**SKILLS**

- 1. Recognizing obvious broken parts and leads of the radio components.
- Ø 2. Listening to the performance of the radio to locate defects.
- Δ 3. Visually inspecting for obvious defects in the cord and plug of the radio.

**INFORMATION**

- Ø 1. Explaining the function of each stage of a radio.
- 2. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners.
  - \* c. Avoiding work situations where moisture is present.
  - \* d. Properly grounding the radio

**TASK 2: CHECKING THE TUBES IN THE SUSPECTED DEFECTIVE STAGE OF THE RADIO****COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- ∅ 2. Reading tube chart and tube manual to determine the type & rating of the tube.
- ∅ 3. Interpreting meter readings of tube tester to determine tube condition.

**MEASUREMENT**

- 1. Comparing measured tube valves with specification.

**SCIENCE**

- \* 1. Explaining the electron theory of current flow in the radio.

**SKILLS**

- ∅ 1. Operating a tube tester to determine condition of tubes.
- ∅ 2. Straightening tube pins with a pin straightener to facilitate testing.
- ∅ 3. Removing tubes from a radio chassis by hand or with a tube puller.
- ∅ 4. Testing for gassy tubes with a tube tester.
- ∅ 5. Testing for shorts or open filaments with the tube tester.

**INFORMATION**

- ∅ 1. Recognizing the different types of tubes by observation.
- ∅ 2. Recognizing the different types of tube sockets by observation.
- ∅ 3. Recognizing the different types of tube testers.

**TASK 3: REMOVING THE CHASSIS FROM THE CABINET FOR EASE OF SERVICING****COMMUNICATION**

- ◊ 1. Reading the manufacturer's schematic to find the disconnect point of the built-in antenna.

**SKILLS**

- \* 1. Disconnecting the line cord from the wall receptacle.
- ◊ 2. Removing knobs from front of cabinet.
- \* 3. Unsoldering antenna leads from built-in antenna with soldering gun.
- Δ 4. Removing the fasteners holding the chassis to the cabinet using the appropriate tools.

**INFORMATION**

- \* 1. Arranging parts in an orderly procedure to prevent loss or damage.
- Δ 2. Selecting the proper type and size of screwdrivers for the job to be done:
  - a. Regular
  - b. Ratchet
  - c. Offset
  - d. Spiral
  - e. Insulated
  - f. Wedge, clip (screw holding)
- Δ 3. Selecting the proper type of screwdriver tips:
  - a. Standard slot
  - b. Cross (Phillips)
  - c. Square (Robertson)
  - d. Socket
  - e. Others
- Δ 4. Selecting the proper types of wrenches for the job to be done:
  - a. Open end
  - b. Box end
  - c. Socket
  - d. Adjustable
  - e. Spanner (hook, face, special)

- ▲ 5. Selecting the proper types and sizes of attachments for the socket wrenches:
  - a. Ratchets
  - b. Extensions
- ▲ 6. Recognizing the proper methods of holding wrenches.
- ▲ 7. Selecting the proper type, size and characteristics of pliers for the work to be done:
  - a. Slip joint
  - b. Combination
  - c. Long, round, and needle nose
  - d. Crimping
  - e. Vise grip
- ▲ 8. Applying the proper methods of holding the work.
- ▲ 9. Applying methods of holding pliers for pulling, pressing and twisting.
- ▲ 10. Recognizing the results of using pliers for removing nuts and bolts.
- ▲ 11. Selecting the proper types and sizes of cutters for the job to be done:
  - a. Side, end and diagonal
  - b. Wire stripper
  - c. Knives
- ▲ 12. Applying the proper procedures for cutting with diagonal cutters.
- ▲ 13. Determining the proper methods of stripping wire.
- ▲ 14. Selecting the proper size & type of nutdriver for the job.
- ▲ 15. Applying the proper care, maintenance and storage of tools.
- ▲ 16. Recognizing the various types of fastening devices:
  - a. Threaded fasteners
  - b. Keys, rivets and springs
  - c. Cotter pins and shear pins
  - d. Retaining rings
- ▲ 17. Recognizing the various types, uses and characteristics of threaded fasteners:
  - a. Bolts and nuts
  - b. Cap screws
  - c. Machine screws

- d. Set screws
- e. Sheet metal and self-tapping screws
- f. Stud bolts

▲ 18. Recognizing the various types and uses of washers:

- a. Flat
- b. Lock

▲ 19. Applying the proper methods of installing threaded fasteners.

▲ 20. Recognizing the difference between right and left hand threads.

- \* 21. Selecting the proper type & size of soldering iron or soldering gun.
- \* 22. Selecting the proper types of tips for soldering irons or soldering gun.

23. Applying the proper safety precautions:

- \* a. Wearing safety shoes with non-conducting soles
- \* b. Removing jewelry & items of clothing containing metal fasteners
- \* c. Avoiding work situations where moisture is present.
- \* d. Disconnecting the appliance from the power supply before starting repair operations
- e. Discharging the capacitors of the appliance
- \* f. Properly grounding the appliance

**TASK 4: ISOLATING THE DEFECTIVE COMPONENTS IN A PARTICULAR STAGE OF THE RADIO**

**COMMUNICATION**

- \* 1. Reading the manufacturer's service reference charts for possible causes of trouble.
- φ 2. Reading the manufacturer's schematic to locate the components.
- \* 3. Interpreting meter readings to determine the condition of the components.

MEASUREMENT

- \* 1. Measuring resistance, voltage, and current flow in the different stages of the radio using the appropriate electrical meters.

MATHEMATICS

- \* 1. Computing Ohm's Law to determine amperage, voltage and resistance.

SCIENCE

- \* 1. Explaining the characteristics of series & parallel circuits used in the radio.
- \* 2. Explaining the electron theory of current flow in the radio.

SKILLS

- 1. Injecting a signal in the proper sequence to isolate the defective stage with a signal generator.
- \* 2. Connecting electrical meters in the proper manner.
- \* 3. Checking the resistance in a particular stage of a radio with a Volt-Ohm meter.
- \* 4. Inspecting the electrical components with the appropriate electrical meters to eliminate the possible cause of trouble until the defective component is found.

INFORMATION

- Ø 1. Recognizing the various parts of the radio.
- Ø 2. Recognizing the color code of resistors.
- Ø 3. Explaining the function of each stage of the radio.
- \* 4. Recognizing the importance of proper connections when using the appropriate electrical meters.
- \* 5. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter

- \* 6. Applying the proper care, maintenance and storage of electrical meters.
- \* 7. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.
- 8. Applying the proper safety precautions:
  - \* a. Wearing safety shoes with non-conducting soles
  - \* b. Removing jewelry & items of clothing containing metal fasteners
  - \* c. Avoiding work situations where moisture is present
  - \* d. Disconnecting the radio from the power supply before starting repair operations
  - e. Discharging the capacitors of the radio
  - \* f. Properly grounding the radio

**TASK 5: REPLACING THE DEFECTIVE COMPONENTS IN A PARTICULAR STAGE OF THE RADIO**

**COMMUNICATION**

- \* 1. Reading the manufacturer's schematic to determine values and location of the components.

**MEASUREMENT**

- \* 1. Measuring the replacement components to determine correct values with the appropriate meters.

**SCIENCE**

- 1. Recognizing the corrosive effects of acid on copper.

**SKILLS**

- 1. Riveting tube sockets in place with a hand riveter.
- 2. Removing the defective components from the chassis with a soldering gun & appropriate tools.

- \* 3. Connecting electrical meters in the proper manner.
- Δ 4. Replacing new components in the circuit with a soldering gun & appropriate tools.
- \* 5. Replacing the defective cord and/or plug.

#### INFORMATION

- 1. Exercising care to prevent damage of components with heat when soldering.
- \* 2. Practicing safe working procedures when soldering.
- Δ 3. Recognizing the importance of using only resin core solder on electrical connections.
- Δ 4. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
- Δ 5. Applying the proper care, maintenance & storage of tools.
- Δ 6. Applying the proper methods of holding the work.
- Δ 7. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 8. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 9. Applying the proper procedures for cutting with diagonal cutters.
- Δ 10. Determining the proper methods of stripping wire.
- \* 11. Recognizing the importance of proper connection of appropriate electrical meters.
- \* 12. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity Tester
  - d. Volt-Ohm meter
- \* 13. Applying the proper care, maintenance and storage of electrical meters.
- \* 14. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.

**TASK 6: REPLACING THE CHASSIS IN THE CABINET AFTER A FINAL INSPECTION OF THE RADIO****COMMUNICATION**

- ◊ 1. Reading the manufacturer's schematic to find the connecting point of the built-in antenna.

**SKILLS**

- \* 1. Soldering built-in antenna leads in place with a soldering gun.
- Δ 2. Replacing all mechanical fasteners using the appropriate tools.

**INFORMATION**

- Δ 1. Selecting the proper type and size of:
  - a. Screwdrivers
  - b. Pliers
  - c. Cutters
  - d. Nutdrivers
- Δ 2. Applying the proper care, maintenance & storage of tools.
- Δ 3. Applying the proper methods of holding the work.
- Δ 4. Applying methods of holding pliers for pulling, pressing and twisting.
- Δ 5. Recognizing the results of using pliers for removing nuts and bolts.
- Δ 6. Applying the proper procedures for cutting with diagonal cutters.
- Δ 7. Determining the proper methods of stripping wire.
- Δ 8. Recognizing the various types of fastening devices.
- Δ 9. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 10. Recognizing the various types and uses of washers.
- Δ 11. Applying the proper methods of installing threaded fasteners.

- Δ 12. Recognizing the difference between right and left hand threads.
- \* 13. Selecting the proper types and sizes of soldering irons and soldering guns.
- \* 14. Selecting the proper types of tips for soldering irons and soldering guns.
- \* 15. Recognizing the importance of tinning the tip of the soldering iron or soldering gun.
- \* 16. Determining the correct composition of solders to use on the radio.
- \* 17. Recognizing the importance and purpose of flux when soldering.
- \* 18. Applying the proper method of transferring heat to work.
- \* 19. Selecting the correct solder and flux.
- \* 20. Selecting the proper method of applying solder.
- \* 21. Practicing safe working procedures when soldering.
- ∅ 22. Recognizing the importance of using only resin core solder on electrical connections.

#### **TASK 7: MAKING FINAL OPERATIONAL CHECKS AND ADJUSTMENTS TO THE RADIO**

##### **SKILLS**

1. Plugging the radio into service outlet.
2. Tuning the radio to a local station.
3. Listening to the radio set on a selected frequency to determine performance.
4. Checking for loose connections on the radio.
5. Adjusting trimmer condensors to peak output position with a screwdriver.

##### **INFORMATION**

1. Recognizing correct operation of the radio from the audio signal.

2. Selecting the proper type and size of screwdrivers.
- Δ 3. Applying the proper care, maintenance & storage of tools.

**TASK 8: OBSERVING THE SYMPTOMS TO DETERMINE THE DEFECTIVE STAGE OF THE TELEVISION SET**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**SKILLS**

1. Recognizing the audio signal characteristics to localize defect.
2. Recognizing video signal characteristics to localize defect.
3. Determining by visual inspection the defective stage of a television.
- \* 4. Visually inspecting for obvious defects in the cord and plug of the television.

**INFORMATION**

- Ø 1. Explaining the characteristics and function of each stage of the television.

**TASK 9: CHECKING THE TUBES IN THE SUSPECTED STAGE**

**COMMUNICATION**

- Δ 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- Ø 2. Reading tube chart and tube manual to determine the type & rating of the tube.
- Ø 3. Interpreting meter readings of tube tester to determine tube condition.

SCIENCE

- \* 1. Explaining the electron theory of current flow in the television.

SKILLS

- Ø 1. Operating a tube tester to determine condition of tubes.
- Ø 2. Straightening tube pins with pin straightener to facilitate testing.
- Ø 3. Removing tubes from a television set with tube puller or lifter.
- Ø 4. Testing for shorts or open filaments with a tube tester.
- Ø 5. Testing for gassy tubes with a tube tester.

INFORMATION

- Ø 1. Recognizing the different types of tubes by observation.
- Ø 2. Recognizing the different types of tube sockets by observation.
- Ø 3. Recognizing the different types of tube testers.

**TASK 10: REMOVING THE CHASSIS FROM THE CABINET FOR EASE OF SERVICING**SKILLS

- 1. Removing back cover screws with screwdriver.
- Δ 2. Removing chassis mounting bolts with appropriate tools.
- Ø 3. Removing the knobs from the front of the set.
- \* 4. Discharging the static charge from the picture tube and high voltage tubes with a screwdriver.

INFORMATION

- \* 1. Arranging parts in an orderly procedure to prevent loss or damage.

**2. Selecting the proper type and size of:**

- a. Screwdrivers
- b. Nutdrivers

- Δ 3. Applying the proper care, maintenance & storage of tools.
- Δ 4. Recognizing the various types of fastening devices.
- Δ 5. Recognizing the various types, uses and characteristics of threaded fasteners.
- Δ 6. Recognizing the various types and uses of washers.
- Δ 7. Applying the proper methods of removing threaded fasteners.
- Δ 8. Recognizing the difference between right and left hand threads.

**9. Applying the proper safety precautions:**

- \* a. Wearing safety shoes with non-conducting soles
- \* b. Removing jewelry & items of clothing containing metal fasteners
- \* c. Avoiding work situations where moisture is present
- \* d. Disconnecting the television from the power supply before starting repair operations
- e. Discharging the capacitors of the television.
- \* f. Properly grounding the television.

**TASK 11: ISOLATING THE DEFECTIVE COMPONENTS IN A PARTICULAR STAGE OF THE TELEVISION SET**

**COMMUNICATION**

- \* 1. Reading manufacturer's service reference charts for possible cause of trouble.
- Ø 2. Reading the manufacturer's schematic to locate components.
- \* 3. Interpreting meter readings to determine conditions of the components.

MATHEMATICS

- \* 1. Computing Ohm's Law to determine amperage, voltage & resistance.

SCIENCE

- \* 1. Explaining the electron theory of current flow in the television.

SKILLS

- 1. Checking the wave forms with an oscilloscope.
- \* 2. Connecting electrical meters in the proper manner.
- 3. Inspecting the electrical components with the appropriate electrical meters to eliminate the possible cause of trouble until the defective component is found.

INFORMATION

- Ø 1. Practicing safety precautions when working with live circuits.
- 2. Identifying the difficult components and their designated values.
- Ø 3. Recognizing the importance of discharging capacitors and picture tube prior to using a VOM in the circuit.
- Ø 4. Explaining the function of each stage of the TV.
- \* 5. Recognizing the importance of proper connections when using the appropriate electrical meters.
- \* 6. Selecting the appropriate electrical meters for the job to be done:
  - a. Voltmeter
  - b. Amp-meter or Amp-probe
  - c. Continuity tester
  - d. Volt-Ohm meter
- \* 7. Applying the proper care, maintenance and storage of electrical meters.
- \* 8. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.

Ø 9. Recognizing the color code of resistors.

**TASK 12: REPLACING THE DEFECTIVE COMPONENTS IN A PARTICULAR STAGE OF THE TELEVISION SET**

**COMMUNICATION**

Ø 1. Reading a schematic to determine values and location of components.

**SKILLS**

Δ 1. Removing the defective components from the chassis with a soldering gun & appropriate tools.

Δ 2. Replacing new components in the circuit with a soldering gun & appropriate tools.

\* 3. Replacing the defective cord and/or plug.

**INFORMATION**

Ø 1. Recognizing the color code of resistors.

Δ 2. Selecting the proper type and size of:

- a. Screwdrivers
- b. Pliers
- c. Cutters
- d. Nutdrivers

Δ 3. Applying the proper care, maintenance & storage of tools.

Δ 4. Applying the proper methods of holding the work.

Δ 5. Applying methods of holding pliers for pulling, pressing, and twisting.

Δ 6. Recognizing the results of using pliers for removing nuts and bolts.

Δ 7. Selecting the proper types and sizes of cutters for the job to be done.

Δ 8. Applying the proper procedures for cutting with diagonal cutters.

- △ 9. Determining the proper methods of stripping wire.
- △ 10. Recognizing the various types of fastening devices.
- △ 11. Recognizing the various types, uses and characteristics of threaded fasteners.
- △ 12. Recognizing the various types and uses of washers.
- △ 13. Applying the proper methods of installing threaded fasteners.
- △ 14. Recognizing the difference between right and left hand threads.
- \* 15. Selecting the proper types and size soldering irons or soldering gun.
- \* 16. Selecting the proper types of tips for soldering irons or soldering guns.
- \* 17. Recognizing the importance of tinning the tip of the soldering iron or soldering gun.
- \* 18. Determining the correct composition of solders to use on the television.
- \* 19. Recognizing the importance and purposes of flux when soldering.
- \* 20. Applying the proper method of transferring heat to work.
- \* 21. Selecting the correct solder and flux.
- \* 22. Selecting the proper method of applying solder.

**TASK 13: REPLACING THE CHASSIS IN THE CABINET AFTER A FINAL INSPECTION OF THE TELEVISION SET**

**COMMUNICATION**

- Ø 1. Reading the manufacturer's schematic to determine the connection points for mounting screws and bolts.

**SKILLS**

- △ 1. Replacing the chassis in the cabinet using the appropriate tools.

\* 2. Soldering antenna leads in place with a soldering gun.

INFORMATION

◊ 1. Observing safe working procedures when installing a chassis.

Δ 2. Selecting the proper type and size of:

- a. Screwdrivers
- b. Pliers
- c. Wrenches
- d. Cutters
- e. Nutdrivers
- f. Hammers
- g. Chisels
- h. Punches
- i. Pullers
- j. Levels

Δ 3. Applying the proper care, maintenance & storage of tools.

Δ 4. Recognizing the proper methods of holding wrenches.

Δ 5. Selecting the proper type, size and characteristics of pliers for the work to be done.

Δ 6. Applying the proper methods by holding the work.

Δ 7. Applying methods of holding pliers for pulling, pressing and twisting.

Δ 8. Recognizing the results of using pliers for removing nuts and bolts.

Δ 9. Applying the proper procedures for cutting with diagonal cutters.

Δ 10. Determining the proper methods of stripping wire.

Δ 11. Recognizing the various types of fastening devices.

Δ 12. Recognizing the various types, uses and characteristics of threaded fasteners.

Δ 13. Recognizing the various types and uses of washers.

Δ 14. Applying the proper methods of installing threaded fasteners.

Δ 15. Recognizing the difference between right and left hand threads.

- \* 16. Selecting the proper types and size soldering irons or soldering gun.
- \* 17. Selecting the proper types of tips for soldering irons or soldering gun.
- \* 18. Recognizing the importance of tinning the tip of the soldering iron or soldering gun.
- \* 19. Determining the correct composition of solders to use on the television.
- \* 20. Recognizing the importance and purposes of flux when soldering.
- \* 21. Applying the proper method of transferring heat to work.
- \* 22. Selecting the correct solder and flux.
- \* 23. Selecting the proper method of applying solder.

#### **TASK 14: MAKING FINAL OPERATIONAL CHECKS AND ADJUSTMENTS TO THE TELEVISION SET**

##### **COMMUNICATION**

- A 1. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.**

##### **SKILLS**

- \* 1. Plugging the television into the service outlet.
- 2. Tuning the television to a local channel.
- 3. Adjusting the horizontal and vertical synchronization to eliminate black edges, and to center the picture.

##### **INFORMATION**

- 1. Recognizing correct operation of the television from audio and video performance.

**TASK 15: INSTALLING AN OUTDOOR TELEVISION ANTENNA AND TRANSMISSION LINE****COMMUNICATION**

Δ 1. Interpreting the manufacturer's instruction for assembling the antenna.

**MATHEMATICS**

1. Determining the resonant length of an antenna.

**SKILLS**

1. Installing the antenna near a line of sight broadside to the transmitter using the appropriate tools.
2. Rotating the antenna to the position that results in the best picture.
3. Mounting the lightning arrestor to provide a high-resistance discharge path for static charge with the appropriate tools.
4. Grounding the mast to prevent accumulation of static charge with the appropriate tools.

**INFORMATION**

1. Utilizing 300-Ohm twinlead ribbon line wherever possible for connecting the antenna to the receiver.
2. Recognizing that transmission lines should be as short as possible between the antenna and the receiver.

Δ 3. Selecting the proper type and size of:

- a. Screwdrivers
- b. Pliers
- c. Wrenches
- d. Cutters
- e. Nutdrivers

Δ 4. Applying the proper care, maintenance & storage of tools.

Δ 5. Recognizing the proper methods of holding wrenches.

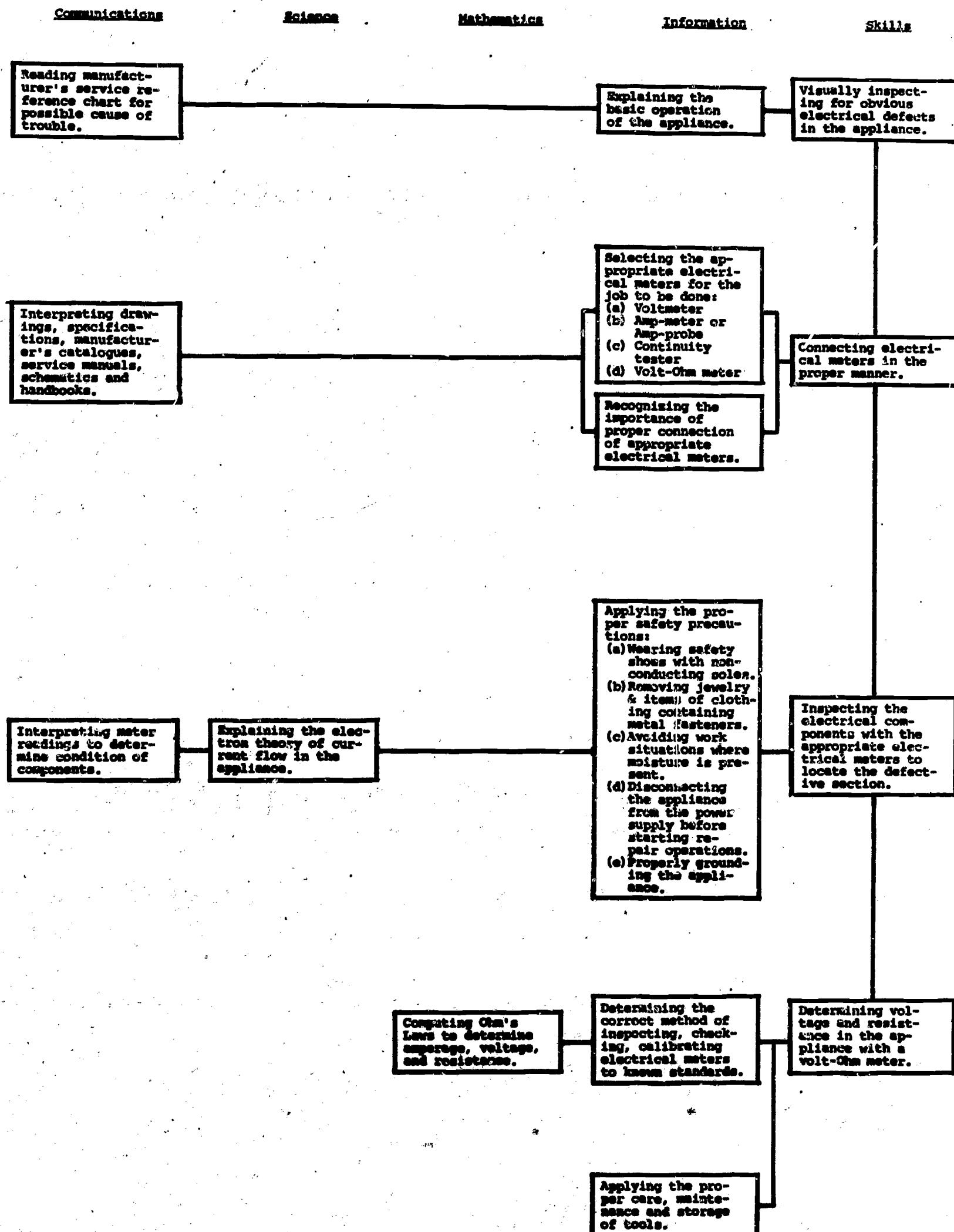
Δ 6. Applying the proper methods of holding the work.

- ▲ 7. Applying methods of holding pliers for pulling, pressing and twisting.
- ▲ 8. Recognizing the results of using pliers for removing nuts and bolts.
- ▲ 9. Applying the proper procedures for cutting with diagonal cutters.
- ▲ 10. Determining the proper methods of stripping wire.
- ▲ 11. Recognizing the various types of fastening devices.
- ▲ 12. Recognizing the various types, uses and characteristics of threaded fasteners.
- ▲ 13. Recognizing the various types and uses of washers.
- ▲ 14. Applying the proper methods of installing threaded fasteners.
- ▲ 15. Recognizing the difference between right and left hand threads.

**INSTRUCTIONAL SEQUENCE EXAMPLE**  
**ELECTRO-MECHANICAL INSTALLATION AND REPAIR**

This section of the report provides a suggested instructional sequence that may be utilized by the teacher in developing a lesson for each of the tasks listed in the task analysis section of the report. The task is shown at the top of the page with the headings for the areas of human requirement listed below the task. Under each heading the behavioral statements have been arranged in a suggested instructional sequence. The arrangement provides the teacher with an instructional pattern that can be used to develop lesson plans, materials of instruction, and visual aids.

## ISOLATING THE DEFECT TO A PARTICULAR SECTION OF THE HEATING ELEMENT APPLIANCE



## **COMMON AREAS OF HUMAN REQUIREMENT**

### **ELECTRO-MECHANICAL INSTALLATION AND REPAIR**

An inventory of skills and knowledges was compiled for each of the occupations in the electro-mechanical installation and repair cluster. An analysis of these skills and knowledges was made to determine their frequency of appearance for each of the occupations in the cluster. The frequency of appearance is shown with respect to the following categories:

- 1. Common to all occupations.**
- 2. Common to several occupations.**

## **AREAS OF HUMAN REQUIREMENT COMMON TO ALL OCCUPATIONS IN THE ELECTRO-MECHANICAL INSTALLATION AND REPAIR CLUSTER**

## **AREAS OF HUMAN REQUIREMENT**

# AREAS OF HUMAN REQUIREMENT

## RADIO AND TELEVISION

## BUSINESS MACHINES

## HOME APPLIANCES

## AIR-CONDITIONING AND REFRIGERATION

## **COMMUNICATION**

## **SKILLS**

1. Removing and replacing fasteners and component parts with the appropriate tools . . . . . 15 33 47 11

## **INFORMATION**

1. Selecting the proper type and size of:													
a. Screwdrivers	.	.	.	.	.	.	.	.	.	8	11	23	3
b. Pliers	.	.	.	.	.	.	.	.	.	4	11	19	3
c. Wrenches	.	.	.	.	.	.	.	.	.	2	11	19	3
d. Cutters	.	.	.	.	.	.	.	.	.	5	11	19	3
e. Nutdrivers	.	.	.	.	.	.	.	.	.	7	11	19	3
2. Recognizing the proper methods of holding wrenches	.	.	.	.	.	.	.	.	.	2	11	19	3
3. Applying proper methods of holding work	.	.	.	.	.	.	.	.	.	5	11	19	3
4. Applying methods of holding pliers for pulling, pressing and twisting	.	.	.	.	.	.	.	.	.	5	11	19	3

AREAS OF HUMAN REQUIREMENT

	RADIO AND TELEVISION	BUSINESS MACHINES	HOME APPLIANCES	AIR-CONDITIONING AND REFRIGERATION
5. Recognizing the results of using pliers for removing nuts and bolts. . . . .	5	11	19	3
6. Applying the proper procedures for cutting with diagonal cutters . . . . .	5	11	19	3
7. Determining the proper methods of stripping wire . . . . . . . . .	5	11	19	3
8. Recognizing the various types of fastening devices . . . . . . . . .	6	11	21	3
9. Recognizing the various types, uses and characteristics of threaded fasteners . . . . . . . . .	6	11	21	3
10. Recognizing the various types and uses of washers . . . . . . . . .	6	11	21	3
11. Applying the proper methods of installing threaded fasteners . . . . .	6	11	21	3
12. Recognizing the difference between right and left hand threads . . . . .	6	11	21	3
13. Applying the proper care, maintenance and storage of tools . . . . .	8	11	19	5

## **AREAS OF HUMAN REQUIREMENT COMMON TO SEVERAL OCCUPATIONS IN THE ELECTRO-MECHANICAL INSTALLATION AND REPAIR CLUSTER**

## **AREAS OF HUMAN REQUIREMENT**

## MEASUREMENT

1. Measuring tolerances and clearances with feeler gauges . . . . .	0	1	3	0
2. Measuring with a steel tape . . . . .	0	0	3	1
3. Measuring refrigerant in the system with a pressure gauge . . . . .	0	0	3	2

AREAS OF HUMAN REQUIREMENT

	RADIO AND TELEVISION	BUSINESS MACHINES	HOME APPLIANCES	AIR-CONDITIONING AND REFRIGERATION

MATHEMATICS

1. Computing Ohm's Law to determine amperage, voltage and resistance. . . . . 2 0 23 0

SCIENCE

1. Explaining the electron theory of current flow . . . . . 4 0 18 0

2. Explaining the characteristics of series and parallel circuits . . . . 1 0 10 0

SKILLS

1. Blowing loose dirt from appliance and business machines with compressed air . . . . . 0 3 5 2

2. Inspecting the electrical components with the appropriate electrical meters. 4 1 20 0

3. Connecting electrical meters in the proper manner . . . . . 4 1 15 0

4. Replacing a defective cord and/or plug . . . . . 2 0 3 0

5. Visually inspecting for obvious defects in the cord and plug. . . . . 2 1 9 0

6. Making and removing soldered connections with a soldering iron or soldering gun . . . . . 4 0 3 0

7. Connecting and disconnecting a line cord to the power supply . . . . . 2 0 3 0

8. Lubricating parts according to specifications indicated in service manuals. 0 3 5 0

## **AREAS OF HUMAN REQUIREMENT**

AREAS OF HUMAN REQUIREMENT

	RADIO AND TELEVISION	BUSINESS MACHINES	HOME APPLIANCES	AIR-CONDITIONING AND REFRIGERATION
4. Selecting the appropriate electrical meters for the job to be done:				
a. Voltmeter . . . . .	3	1	19	0
b. Amp-meter or Amp-probe . . . . .	3	1	19	0
c. Continuity tester . . . . .	3	1	19	0
d. Volt-Ohm meter . . . . .	3	1	19	0
5. Applying the proper care, maintenance and storage of electrical meters . . . . .	3	1	19	0
6. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards . . . . .	3	1	19	0
7. Recognizing the different types of refrigerants . . . . .	0	0	1	1
8. Practicing safety procedures when handling refrigerants . . . . .	0	0	2	2
9. Explaining the effects of contaminants in the refrigeration system . . . . .	0	0	1	1
10. Selecting the proper types of cleaning solutions . . . . .	0	3	2	0
11. Practicing proper safety procedures when soldering . . . . .	2	0	0	1
12. Selection of the proper types and size soldering irons . . . . .	5	0	3	0
13. Selection of the proper types of tips for soldering irons . . . . .	5	0	3	0
14. Recognizing the importance of tinning the tip of the soldering iron . . . . .	4	0	3	0

AREAS OF HUMAN REQUIREMENT

	RADIO AND TELEVISION	BUSINESS MACHINES	HOME APPLIANCES	AIR-CONDITIONING AND REFRIGERATION
15. Determining the correct composition of solders to use on the appliance. . . . .	4	0	3	0
16. Recognizing the importance and purposes of flux when soldering. . . . .	4	0	3	0
17. Applying the proper method of transferring heat to work. . . . . . .	4	0	3	0
18. Selecting the correct solder and flux. . . . . . . . . . .	4	0	3	1
19. Selecting the proper method of applying solder. . . . . . . . .	4	0	3	0
20. Arranging parts in an orderly procedure to prevent loss or damage . . . . .	2	1	0	0

## **COURSE OUTLINE**

### **ELECTRO-MECHANICAL INSTALLATION AND REPAIR**

This section of the report includes the course outline for the electro-mechanical installation and repair cluster. The course outline is divided into a first and second level program. Units of instruction have been developed that provide the manipulative and verbal learnings required for job entry into each of the occupations found in the cluster. A list of suggested learning activities has been provided for each unit as well as a list of instructional materials for each occupational area.

**COURSE DESCRIPTION:** The course outline for the occupational cluster of electro-mechanical installation and repair is designed to be used in a cluster concept program in vocational education at the secondary school level. The program is aimed at the development of skills and understandings related to a group of occupations within the electro-mechanical installation and repair cluster. It is not an in-depth development into any one occupation, but aims at preparing students to enter a range of occupations within the electro-mechanical installation and repair cluster.

**NEED FOR THE COURSE:** The course is designed to meet the needs of students pursuing a general curriculum in the secondary school system by providing job entry skills in a number of related occupations. It is also designed to meet the student's need for self appraisal of interests and potentialities in a number of occupations:

Specific needs include the following:

1. To provide students with the opportunity for a greater degree of mobility on a geographical basis.
2. To provide students with the opportunity for mobility within an industry or occupation.
3. To provide students with the opportunity for greater flexibility in occupational choice patterns.
4. To develop students who will be adaptable to technological changes.

**COURSE OBJECTIVES:** The course for the electro-mechanical installation and repair cluster will be directed toward the following objectives:

1. To broaden the student's knowledge of the available opportunities in the occupations found in the electro-mechanical installation and repair cluster.

2. To develop job entry skills and knowledge for several occupations found in the electro-mechanical installation and repair cluster.
3. To develop safe habits and a favorable attitude toward work in the electro-mechanical installation cluster.
4. To develop a student's insight into the sources of information that will be helpful to him as he moves through the occupational areas.

**The specific objectives for the course are the following:**

1. To develop the student's competency in the use of common hand tools found in the electro-mechanical installation and repair cluster
2. To develop the student's competency in using power tools and equipment needed for job entry into the occupations found in the electro-mechanical installation and repair cluster.
3. To develop the student's understanding of the operations, procedures, and processes associated with the electro-mechanical installation and repair cluster.
4. To develop safe working habits related to the occupations within the electro-mechanical installation and repair cluster.
5. To familiarize the student with the terminology associated with the electro-mechanical installation and repair cluster.
6. To develop an understanding of the resources available to him in his pursuit of the course as well as in his work following graduation.

**PROCEDURE:** It is recommended that the course be offered during the student's junior and senior year in high school. Instruction should be provided for two periods a day, five days a week, during the school year. The level I experiences were designed for the junior year (or first year) program and the Level II experiences were designed for the second year or senior year program.

The most appropriate facility would be a self-contained laboratory unit containing the essential tools and equipment necessary for teaching job entry tasks in the electro-mechanical installation and repair cluster.

The instructor should be a person with some experience and competence in the occupations included in the cluster. The course should be organized by the teacher on a multiple activity basis with groups of students rotating through the specific occupational areas. The common areas of human requirement needed to perform the tasks in the cluster should be emphasized so that an opportunity is provided for the students to transfer the common skill or knowledge from one occupation to another.

The possibility of team teaching procedures would be appropriate for the electro-mechanical installation and repair cluster. Specialists in the different occupational areas would participate in the instructional program. The team teachers could be other vocational teachers as well as competent individuals from the community.

The instructor of the course should coordinate his program with other teachers in the school to develop the competencies in mathematics, science, and communication that will be needed for successful performance in the occupations found in the electro-mechanical installation and repair cluster. Community resources, such as local industries, employment agencies, and tradesmen should be utilized to provide occupational information and knowledge needed concerning the performance of the tasks in the electro-mechanical installation and repair cluster.

**The course should be supplemented with field trips, films, and other educational media. A suggested list is provided at the end of each occupational area in the course outline.**

**LEVEL I EXPERIENCES**  
**FIRST YEAR PROGRAM**

## AIR CONDITIONING AND REFRIGERATOR SERVICEMAN EXPERIENCES - - LEVEL I

### Unit I

#### Title: Testing Lines with Detection Device for Leaks.

Objective: To develop in the individual the capability for testing lines with leak detection devices.

#### Manual or Manipulative Learning:

- A. Regulating the pressure on a halide leak detector.
- B. Applying the proper procedures when using the halide leak detector.
- C. Applying the proper procedures when using an electronic leak detector.
- D. Applying the proper procedures when checking for refrigerant leaks when using (a) soap test, (b) litmus paper, (c) sulphur stick.

#### Verbal Learning:

##### Communication:

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- B. Interpreting instructions and information located on the data plate of the unit.

##### Science:

- A. Explaining the chemistry of refrigerants and their reaction in contact with other materials.

#### General Information

- A. Recognizing the different types of refrigerants.
- B. Demonstrating proper safety precautions when testing for refrigerant leaks in enclosed spaces.
- C. Practicing safety procedures when handling refrigerants.
- D. Selecting the proper type of refrigerant according to specifications.

All student activities should be as practical and meaningful as possible. Using actual leak detection devices and refrigerators will assist in this process.

- A. Using a halide leak detector to test for leaks in refrigerator system.
- B. Utilizing manual leak testing methods such as (a) soap test, (b) litmus paper, (c) sulphur stick to check for leaks in the refrigerator system.
- C. Testing the refrigerator system for leaks with an electronic leak detector.
- D. Working with refrigerants and observing their reaction when brought in contact with other materials.
- E. Reading manufacturer's service manual to determine the type of refrigerant used and the prescribed method of testing for leaks.

Unit II

**Title:** Installing the Gauge Manifold on the Condenser to Facilitate the Evacuation and Charging of the Unit.

**Objective:** To develop in the individual the capability for installing the gauge manifold, evacuating, and charging the system.

Manual or Manipulative Learning:

A. Demonstrating the proper procedures for connecting a service gauge manifold when evacuating and/or charging the system.

Verbal Learning:

Communication:

A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.  
B. Interpreting instructions and information located on the data plate of the unit.  
C. Reading instruments (gauges) to determine the desired vacuum.  
D. Interpreting gauges to determine the depth and duration of vacuum as indicated in the specifications.

Measurement:

A. Measuring the refrigerant in the system with a pressure gauge.

Mathematics:

A. Converting inches of vacuum to percent of air.

B. Converting gauge pressure to absolute,  
inches or millimeters of mercury.

Science:

A. Explaining the process of charging a liquid to a gas.

General Information

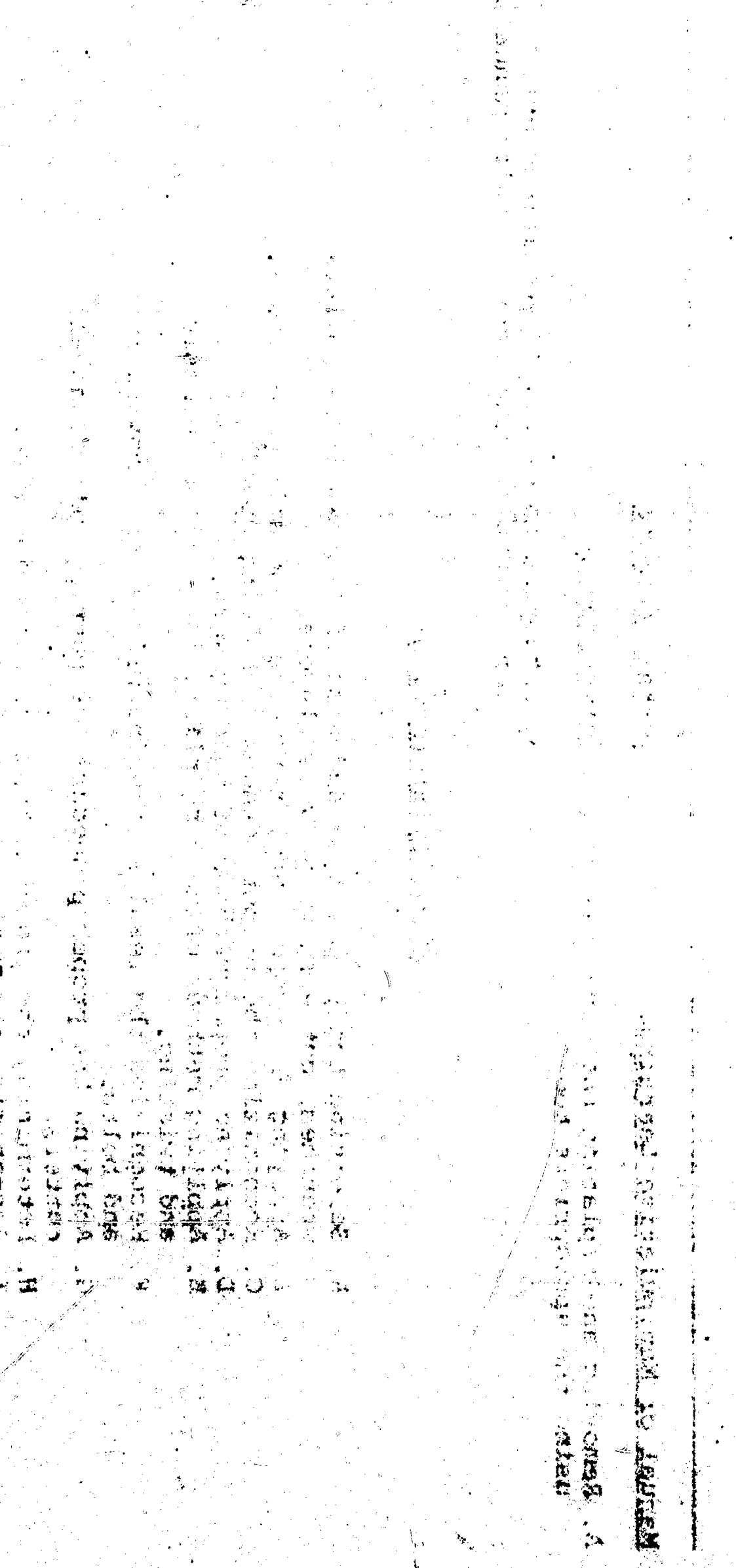
- A. Caring for various types of vacuum pumps.
- B. Recognizing the various types of gauges.
- C. Recognizing the types and uses of manometers.
- D. Recognizing the types and uses of wet wick vacuum indicators.
- E. Recognizing the necessary care when using vacuum indicators.
- F. Recognizing the results of excessive pressures in the refrigerator system.
- G. Applying the proper care, maintenance and storage of instruments.
- H. Explaining the effects of mercury in the system.
- I. Explaining the effects of moisture in the system.
- J. Explaining the effects of non-condensable gasses in the system.
- K. Explaining the process of using a vacuum pump connected to the refrigerator compressor to draw a vacuum in the system.

Suggested Student Activities

All student activities should be as practical and meaningful as possible. The use of actual items involved may assist in this process.

- A. Installing the gauge manifold in the refrigerator system to facilitate testing for pressure and an indication of the level of vacuum.
- B. Reading the service manual to determine the correct location for installing the gauges.
- C. Working with percentages and conversion tables concerning vacuum.

D. Following the conversion of a liquid to a gas and back to a liquid in the system.



### Unit III

#### Title: Removing and Replacing the Cover on a Refrigerator or Air Conditioning Unit.

Objective: To develop in the individual the capability for using hand tools when working with refrigerators and air conditioning units.

#### Manual or Manipulative Learning:

- A. Removing and replacing the cover plates using the appropriate tools.

#### Verbal Learning:

##### Communication:

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals.

#### General Information

- A. Selecting the proper type and size of (screwdrivers, pliers, wrenches, cutters, nutdrivers, levels).
- B. Applying the proper care, maintenance and storage of tools.
- C. Recognizing the proper methods of holding wrenches.
- D. Applying proper methods of holding work.
- E. Applying methods of holding pliers for pulling, pressing, and twisting.
- F. Recognizing the results of using pliers for removing nuts and bolts.
- G. Applying the proper procedure for cutting with diagonal cutters.
- H. Determining the proper methods of stripping wire.
- I. Recognizing the various types of fastening devices.
- J. Recognizing the various types, uses and characteristics of threaded fasteners.

- K. Recognizing the various types and uses of washers.
- L. Applying the proper methods of installing threaded fasteners.
- M. Recognizing the difference between right and left hand threads.

Suggested Student Activities

All student activities should be as practical and meaningful as possible. The use of actual refrigerators and air conditioners may assist in this process.

- A. Working with small hand tools in the accomplishment of the task of removing and replacing the cover plates on a refrigerator or air conditioner.
- B. Reading the service manuals to determine the correct procedure for removing and replacing the cover plates.

Unit IV

**Title:** Occupational Information Pertaining to Air conditioning and Refrigerator Servicing and Related Occupations.

**Objective:** To acquaint the individual with the opportunities in air conditioning and refrigerator servicing and related occupations.

Occupational Information

Obtaining information about:

- A. The employment outlook.
- B. The wage scale.
- C. The types of training available.
- D. The working conditions experienced in the occupation.
- E. The physical and mental characteristics needed for qualification for employment.
- F. The geographical location of employment.
- G. The opportunities for advancement.
- H. The advantages and disadvantages of the occupation.
- I. The nature of the work involved in the occupation.
- J. The union involvement in the occupation.
- K. The means of entry into the occupation.

### Suggested Student Activities

All student activities should be as practical and meaningful as possible. The use of actual refrigerators and air conditioners may assist in this process.

- A. Writing specific information concerning opportunities in the occupations of the electro-mechanical installation and repair cluster.
- B. Visiting an office of the State Employment Service.
- C. Listening to a speaker from a trade union.
- D. Writing letters to correspondence and trade schools in order to determine opportunities for additional training.
- E. Visiting a school for apprentices.
- F. Visiting a refrigerator manufacturer or service center.
- G. Watching movies of refrigeration and how it works.
- H. Reading the Occupational Outlook Handbook.

**LEVEL II EXPERIENCES**

**SECOND YEAR PROGRAM**

Unit I

**Title:** The Installation of Tubing Between the Case and Condensing Unit.

**Objective:** To develop in the individual the capability for performing the necessary steps in the installing tubing in a refrigerator or air conditioner.

**Manual or Manipulative Learning:**

- A. Bending tubing with a machine and spring to fit the unit.
- B. Cleaning the tubing with abrasive cloth for soldering to remove the corrosion.
- C. Cutting the tubing to specific lengths
- D. Reaming the tubing to remove the inside burr with a hand reamer.
- E. Flaring the tubing with a flaring tool to insure a proper seal.
- F. Soldering tubing with soft or silver solder with a torch.

**Verbal Learning:**

**Communication:**

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics, and handbooks.
- B. Interpreting instructions and information located on the data plate of the unit.

**Measurement:**

- A. Measuring the inside diameter and the outside diameter of tubing with calipers and rule.
- B. Measuring the length of tubing with steel tape to an accuracy of  $1/16$  of an inch.

**Mathematics:**

- A. Adding numbers and fractions to determine the total length of tubing.

Science:

- A. Explaining the physical properties of copper when being worked or exposed to the elements.

General Information

- A. Explaining how to make allowances for bends.
- B. Applying the proper care, maintenance and storage of the tubing cutter.
- C. Selecting the proper types of fluxes and solders for their respective uses.
- D. Selecting the proper type and size of reamer for the job to be done.
- E. Practicing safety precautions when soldering.

Suggested Student Activities

All student activities should be as practical and meaningful as possible. The use of actual items may assist in this process.

- A. Reading the service manual to determine the correct size of tubing required for a particular refrigerator system.
- B. Measuring the diameter and length of tubing with calipers and steel tape.
- C. Cutting, bending, flaring and cleaning the tubing in preparation for installation.
- D. Soldering the tubing with soft or silver solder using a torch.

**AIR CONDITIONING AND REFRIGERATOR SERVICING EXPERIENCES - - LEVEL II**

**Unit II**

**Title:** Testing Lines with Detection Device for Leaks.

**Objective:** To develop in the individual the capability for testing lines with leak detection devices.

**Manual or Manipulative Learning:**

- A. Regulating the pressure on a halide leak detector.
- B. Applying the proper procedures when using the halide leak detector.
- C. Applying the proper procedures when using an electronic leak detector.
- D. Applying the proper procedures when checking for refrigerant leaks when using (a) soap test, (b) litmus paper, (c) sulphur stick.

**Verbal Learning:**

**Communication:**

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- B. Interpreting instructions and information located on the data plate of the unit.

**Science:**

- A. Explaining the chemistry of refrigerants and their reaction in contact with other materials.

**General Information**

- A. Recognizing the different types of refrigerants.
- B. Demonstrating proper safety precautions when testing for refrigerant leaks in enclosed spaces.
- C. Practicing safety procedures when handling refrigerants.
- D. Selecting the proper type of refrigerant according to specifications.

All student activities should be as practical and meaningful as possible. Using actual leak detection devices and refrigerators will assist in this process.

- A. Using a halide leak detector to test for leaks in refrigerator system.
- B. Utilizing manual leak testing methods such as (a) soap test, (b) litmus paper, (c) sulphur stick to check for leaks in the refrigerator system.
- C. Testing the refrigerator system for leaks with an electronic leak detector.
- D. Working with refrigerants and observing their reaction when brought in contact with other materials.
- E. Reading manufacturer's service manual to determine the type of refrigerant used and the prescribed method of testing for leaks.

AIR CONDITIONING AND REFRIGERATOR SERVICING EXPERIENCES - - LEVEL II

Unit III

**Title:** Installing the Gauge Manifold on the Condenser to Facilitate the Evacuation and Charging of the Unit.

**Objective:** To develop in the individual the capability for installing the gauge manifold, evacuating, and charging the system.

**Manual or Manipulative Learning:**

A. Demonstrating the proper procedures for connecting a service gauge manifold when evacuating and/or charging the system.

**Verbal Learning:**

**Communication:**

- A. Interpreting drawings, specifications, schematics and handbooks.
- B. Interpreting instructions and information located on the data plate of the unit.
- C. Reading instruments (gauges) to determine the desired vacuum.
- D. Interpreting gauges to determine the depth and duration of vacuum as indicated in the specifications.

**Measurement:**

- A. Measuring the refrigerant in the system with a pressure gauge.

**Mathematics:**

- A. Converting inches of vacuum to percent of air.

B. Converting gauge pressure to absolute, inches or millimeters of mercury.

Science:

A. Explaining the process of changing a liquid to a gas.

General Information

- A. Caring for various types of vacuum pumps.
- B. Recognizing the various types of gauges.
- C. Recognizing the types and uses of manometers.
- D. Recognizing the types and uses of wet wick vacuum indicators.
- E. Recognizing the necessary care when using vacuum indicators.
- F. Recognizing the results of excessive pressures in the refrigerator system.
- G. Applying the proper care, maintenance and storage of instruments.
- H. Explaining the effects of mercury in the system.
- I. Explaining the effects of moisture in the system.
- J. Explaining the effects of non-condensable gases in the system.
- K. Explaining the process of using a vacuum pump connected to the refrigerator compressor to draw a vacuum in the system.

Suggested Student Activities

All student activities should be as practical and meaningful as possible. The use of actual items involved may assist in this process.

- A. Installing the gauge manifold in the refrigerator system to facilitate testing for pressure and an indication of the level of vacuum.
- B. Reading the service manual to determine the correct location for installing the gauges.
- C. Working with percentages and conversion tables concerning vacuum.

D. Following the conversion of a liquid to a gas and back to a liquid in the system.

## Unit IV

**Title:** Introductory Experiences in the Maintenance of Air conditioning and Refrigeration Units.

**Objective:** To develop in the individual the capability for replacing defective components in a refrigeration unit.

### Manual or Manipulative Learning:

- A. Demonstrating the proper techniques of using a torch for soldering and unsoldering joints.
- B. Cutting tubing to specific length with a tubing cutter.
- C. Reaming tubing to remove the inside burr with a hand reamer.
- D. Flaring tubing for a coupling with a flaring tool to insure a proper seal.
- E. Charging the refrigeration system with the specified refrigerant.
- F. Replacing the defective components with the appropriate tools.

### Verbal Learning:

#### Communication:

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

#### Measurement:

- A. Measuring the inside and outside diameter of tubing with calipers and rule.
- B. Measuring the length of tubing with a steel tape to an accuracy of 1/8 of an inch.
- C. Measuring refrigerant in the system with a pressure gauge.

#### Mathematics:

- A. Adding numbers and fractions to determine the total length of tubing.

Science:

- A. Recognizing the properties of non-ferrous metals when making solderless connections.

General Information

- A. Selecting the proper type of solder recommended for refrigeration sweat joints.
- B. Selecting the proper type and size of reamer for the job to be done.
- C. Selecting the proper type and size of (screwdrivers, pliers, wrenches, nutdrivers, level, tubing cutter, reamer, and flaring tool).
- D. Applying the proper care, maintenance and storage of tools.
- E. Recognizing the proper methods of holding wrenches.
- F. Applying the proper methods of holding work.
- G. Applying the proper methods of holding pliers for pulling, pressing and twisting.
- H. Recognizing the results of using pliers for removing nuts and bolts.
- I. Applying the proper procedures for cutting with diagonal cutters.
- J. Determining the proper methods of stripping wire.
- K. Recognizing the various types of fastening devices.
- L. Recognizing the various types, uses and characteristics of threaded fasteners.
- M. Recognizing the various types and uses of washers.
- N. Applying the proper methods of installing threaded fasteners.
- O. Recognizing the difference between right and left hand threads.

All student activities should be as practical and meaningful as possible. The use of actual items such as air conditioners, and refrigerators may assist in this process.

- A. The installing of gauges on the unit for the purpose of determining the charge pressure and amount of vacuum.
- B. Cutting, reaming and flaring tubing to be installed on the unit.
- C. Charging the refrigerator system with the specified refrigerant determined by reading the service manual.
- D. Replacing the defective components by approved methods using the appropriate tools.
- E. Making solderless connections with a crimping tool and clamp.

Unit V

**Title:** Occupational Information Pertaining to Air conditioning and Refrigerator Servicing and Related Occupations.

**Objective:** To acquaint the individual with the opportunities in air conditioning and refrigerator servicing and related occupations.

Occupational Information

Obtaining information about:

- A. The employment outlook.
- B. The wage scale.
- C. The types of training available.
- D. The working conditions experienced in the occupation.
- E. The physical and mental characteristics needed for qualification for employment.
- F. The geographical location of employment.
- G. The opportunities for advancement.
- H. The advantages and disadvantages of the occupation.
- I. The nature of the work involved in the occupation.
- J. The union involvement in the occupation.
- K. The means of entry into the occupation.

All student activities should be as practical and meaningful as possible. The use of actual items such as air conditioners, and refrigerators may assist in this process.

A. Writing specific information concerning opportunities in the occupations of the electro-mechanical installation and repair cluster.

- B. Visiting an office of the State Employment Service.
- C. Listening to a speaker from a trade union.
- D. Writing letters to correspondence and trade schools in order to determine opportunities for additional training.
- E. Visiting a school for apprentices.
- F. Visiting a refrigerator manufacturer or service center.
- G. Watching movies of refrigeration and how it works.
- H. Reading the Occupational Outlook Handbook.

INSTRUCTIONAL MATERIALS FOR AIR CONDITIONING AND REFRIGERATION SERVICING

TYPE	TITLE	DESCRIPTION	SOURCE
Book	<u>Modern Refrigeration and Air-Conditioning</u> by A. D. Althouse and C. H. Turnquist	Book covers practical application of refrigeration in all its branches.	Goodheart-Wilcox Co.
Book	<u>Residential And Commercial Air-Conditioning</u> by C. H. Burkhardt	Installation, servicing, types of equipment and refrigeration theory are included in the book.	McGraw-Hill Book Co.
Book	<u>Modern Air-Conditioning Practice</u> by Norman C. Harris	Descriptive text for technicians and application engineers.	McGraw-Hill Book Co.
Book	<u>Commercial and Industrial Refrigeration</u> by C. W. Nelson	Book approaches the study of refrigeration from the practical point of view.	McGraw-Hill Book Co.
Film	<u>Principles of Refrigeration</u>	Film explains the basic physics of heat transfer. Shows compression and absorption systems. 20 min. B & W.	Visual Instruction Bureau
Film	<u>Mechanical Refrigeration: How it Works</u>	Film explains the operation and theory of a refrigeration. 22 min. B & W. \$48.25	Norwood Films

**LEVEL I EXPERIENCES**  
**FIRST YEAR PROGRAM**

Unit 1

**Title:** Determining the Cause and Locating the Trouble in Typewriters.

**Objective:** To develop in the individual the capability for observing the symptoms and isolating the defective components in the typewriters.

**Manual or Manipulative Learning:**

- A. Operating the typewriter in order to observe the malfunction.
- B. Visually inspecting the typewriter for obvious defects.
- C. Visually inspecting for broken parts, missing screws or other obvious defects.
- D. Connecting electrical meters in the proper manner.
- E. Inspecting the electrical components with a continuity tester or Volt-Ohm meter to eliminate the possible cause of trouble until the defective component is found.

**Verbal Learning:**

**Communication:**

- A. Interpreting the customer complaint concerning the malfunction of the typewriter.
- B. Reading the manufacturer's service reference charts for the possible cause of trouble.
- C. Interpreting meter readings to determine the condition of the components.
- D. Interpreting the manufacturer's diagrams to follow the movement of parts in the typewriter.

**Measurement:**

- A. Checking the clearances between parts with a feeler gauge.

**General Information**

- A. Explaining the basic operation of the typewriter.
- B. Explaining the function and movement of each part of the typewriter.

- C. Recognizing the various parts of the typewriter.
- D. Observing safety precautions when working with live circuits.
- E. Recognizing the importance of the proper connection of the appropriate electrical meters.
- F. Selecting the appropriate electrical meters for the job to be done (voltmeter, Amp-meter or Amp-probe, Contunity tester, Volt-Ohm meter).
- G. Applying the proper care, maintenance and storage of electrical meters.
- H. Determining the correct method of inspecting, checking, and calibrating electrical meters to known standards.

#### Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of actual business machines may assist in this process.

- A. Inspecting the electrical components with a Volt-Ohm meter to locate the cause of electrical defects.
- B. Inspecting the typewriter for broken or defective parts, dirt, or any special repairs which need to be done.
- C. Manually operating the typewriter and following the parts movement to locate the defect.
- D. Identifying typewriter parts from diagrams in the service manual.

Unit II

**Title:** Introductory Exercises in the Servicing of Typewriters.

**Objective:** To develop in the individual the capability for disassembling and reassembling the typewriter.

**Manual or Manipulative Learning:**

- A. Removing and replacing the ribbon, platen, feed rollers, rubber feed, and all other rubber or fabric parts of the typewriter which might be affected by cleaning solution, by hand, or with the appropriate tools.
- B. Removing and replacing the carriage assembly, side and cover plates, and fasteners from the typewriter with the appropriate tools.
- C. Removing and replacing electrical components and connections for the typewriter with the appropriate tools.
- D. Removing and replacing the defective part of the typewriter with special tools indicated in the service manual.
- E. Reassembling the repaired typewriter with the special and conventional tools indicated in the service manual.

**Verbal Learning:**

- Communications:**
  - A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
  - B. Interpreting the manufacturer's diagrams to follow the movement of parts in the typewriter.

A. Recognizing the various parts of the typewriter.  
B. Selecting the proper type and size of screwdrivers, pliers, wrenches, cutters, nutdrivers.  
C. Applying the proper care, maintenance and storage of tools.  
D. Recognizing the proper methods of holding wrenches.  
E. Applying the proper methods of holding the work.  
F. Applying methods of holding pliers for pulling, pressing, and twisting.  
G. Recognizing the results of using pliers for removing nuts and bolts.  
H. Applying the proper procedures for cutting with diagonal cutters.

I. Determining the proper methods of stripping wire.  
J. Recognizing the various types of fastening devices.  
K. Recognizing the various types, uses and characteristics of threaded fasteners.  
L. Recognizing the various types and uses of washers.  
M. Applying the proper methods of installing threaded fasteners.  
N. Recognizing the difference between right and left hand threads.

Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of actual business machines may assist in this process.

A. Disassembling typewriters for minor repairs, reconditioning or rebuilding.  
B. Reassembling of the repaired, reconditioned or rebuilt typewriter following diagrams and instructions in the service manual.  
C. Removing, making minor repairs and re-installing motors in the power driven machines.  
D. Identifying special and common tools used in the repair, service and maintenance of the typewriter from a diagram.

BUSINESS MACHINE SERVICING EXPERIENCES - - LEVEL I

Unit III

Title: Replacing Components and Testing the Repaired Typewriter.

Objective: To develop in the individual the capability for cleaning the typewriter, recognizing and replacing the defective parts, and testing the repaired typewriter.

Manual or Manipulative Learning:

- A. Blowing loose dirt from the typewriter with compressed air.
- B. Washing the typewriter with water to remove loose dirt.
- C. Placing the typewriter in the cleaning solution.
- D. Placing the typewriter in an oven to evaporate all possible moisture.
- E. Lubricating the typewriter with a light oil.
- F. Replacing all defective parts with conventional or special tools as indicated in the service manual.
- G. Lubricating the parts to specifications indicated in the service manual.
- H. Operating the typewriter to determine performance.

Verbal Learning:

- Communication:
  - A. Interpreting directions on cleaning solutions for proper mixing.
  - B. Interpreting instructions from the service manual for check points on the typewriter.
- Measurement:
  - A. Measuring liquids in ounces, pints, quarts, and gallons.
- Science:
  - A. Recognizing the flammable and explosive properties of cleaning solutions.

General Information

- A. Selecting the proper type of solution for cleaning the typewriter.

- B. Recognizing the various parts of the typewriter.
- C. Practicing safety procedures noted in the service manual.
- D. Explaining the basic operation of the typewriter.
- E. Explaining the function and movement of each part of the typewriter.
- F. Selecting the proper type and size of screwdrivers, pliers, wrenches, cutters, nutdrivers.
- G. Applying the proper care, maintenance and storage of tools.
- H. Recognizing the proper methods of holding wrenches.
- I. Applying the proper methods of holding the work.
- J. Applying methods of holding pliers for pulling, pressing, and twisting.
- K. Recognizing the results of using pliers for removing nuts and bolts.
- L. Applying the proper procedures for cutting with diagonal cutters.
- M. Determining the proper methods of stripping wire.
- N. Recognizing the various types of fastening devices.
- O. Recognizing the various types, uses and characteristics of threaded fasteners.
- P. Recognizing the various types and uses of washers.
- Q. Applying the proper methods of installing threaded fasteners.
- R. Recognizing the difference between right and left hand threads.

#### Suggested Student Activities

All student activities should be made practical and meaningful as possible. The use of actual business machines may assist in this process.

- A. Selecting and replacing defective or worn-out parts and making the necessary adjustments in connection with these replacements by following diagrams and instructions in the service manual.
- B. Replacing and aligning type on typewriter and soldering type to type bar.
- C. Cleaning and washing typewriters and parts.
- D. Routine servicing and lubrication of typewriter.
- E. Testing power driven machines for operational faults and making necessary corrective adjustments.

**F. Checking reassembled manually operated machines and making corrective adjustments.**

Unit IV

**Title:** Occupational Information Pertaining to Business Machine Servicing and Related Occupations.

**Objective:** To acquaint the individual with the opportunities in business machine servicing and related occupations.

Occupational Information

Obtaining information about:

- A. The employment outlook.
- B. The wage scale.
- C. The types of training available.
- D. The working conditions experienced in the occupation.
- E. The physical and mental characteristics needed for qualification for employment.
- F. The geographical location of employment.
- G. The opportunities for advancement.
- H. The advantages and disadvantages of the occupation.
- I. The nature of the work involved in the occupation.
- J. The union involvement in the occupation.
- K. The means of entry into the occupation.

### Suggested Student Activities

All student activities should be made practical and meaningful as possible. The use of actual business machines may assist in this process.

- A. Writing specific information concerning opportunities in the occupations of the electro-mechanical installation and repair cluster.
- B. Visiting an office of the State Employment Service.
- C. Listening to a speaker from a trade union.
- D. Writing letters to correspondence and trade schools in order to determine opportunities for additional training.
- E. Visiting a school for apprentices.
- F. Visiting a business machine repair shop.
- G. Reading the Occupational Outlook Handbook.

**LEVEL II EXPERIENCES**  
**SECOND YEAR PROGRAM**

Unit I

**Title:** Introductory Exercises in the Servicing of Calculators and Adding Machines.

**Objective:** To develop in the individual the capability for disassembling and reassembling calculators and adding machines.

Manual or Manipulative Learning:

- A. Removing and replacing the ribbon, platen, feed rollers, rubber feet, and all other rubber or fabric parts of calculators and adding machines which might be affected by cleaning solvents with the appropriate tools or by hand.
- B. Removing and replacing fasteners, side, and cover plates from the calculator and adding machine with the appropriate tools.
- C. Removing and replacing all electrical components and connections from the calculator with the appropriate tools.
- D. Removing and replacing the defective parts of the calculator and adding machine with conventional or special tools indicated in the service manual.
- E. Reassembling the repaired calculators and adding machines with special and conventional tools indicated by the service manual.

Verbal Learning:

Communication:

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- B. Interpreting the manufacturer's diagrams to follow the movement of parts in the calculator and adding machine.
- C. Interpreting instructions from the service manual for check points.

- A. Recognizing the various parts of the calculator and adding machine.
- B. Practicing safety procedures noted in the service manual when disassembling and reassembling calculators and adding machines.
- C. Arranging parts in an orderly procedure to prevent loss or damage when disassembling the calculator.
- D. Operating the calculator and adding machine to determine the performance.
- E. Explaining the basic operation of calculators and adding machines.
- F. Explaining the function and movement of each part of the calculators and adding machines.
- G. Selecting the proper type and size of screwdrivers, pliers, wrenches, cutters, nutdrivers.
- H. Applying the proper care, maintenance and storage of tools.
- I. Recognizing the proper methods of holding wrenches.
- J. Applying the proper methods of holding the work.
- K. Applying methods of holding pliers for pulling, pressing, and twisting.
- L. Recognizing the results of using pliers for removing nuts and bolts.
- M. Applying the proper procedures for cutting with diagonal cutters.
- N. Determining the proper methods of stripping wire.
- O. Recognizing the various types of fastening devices.
- P. Recognizing the various types, uses and characteristics of threaded fasteners.
- Q. Recognizing the various types and uses of washers.
- R. Applying the proper methods of installing threaded fasteners.
- S. Recognizing the difference between right and left hand threads.

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**Suggested Student Activities**

All student activities should be made as practical and meaningful as possible. The use of actual appliances may assist in this process.

- A. Disassembling calculators and adding machines for minor repairs, reconditioning or rebuilding.
- B. Reassembling of the repaired, reconditioned or rebuilt calculators and adding machines following diagrams and instructions in the service manual.
- C. Removing, making minor repairs and re-installing motors in the power driven machines.
- D. Identifying special and common tools used in the repair, service and maintenance of calculators and adding machines from a diagram.

Unit II

**Title:** Replacing Components and Testing the Repaired Calculators and Adding Machines.

**Objective:** To develop in the individual the capability for cleaning, recognizing and replacing the defective parts, and testing the repaired typewriter.

**Manual or Manipulative Learning:**

- A. Blowing loose dirt from the calculator and adding machine with compressed air.
- B. Washing the calculator or adding machine with water to remove loose dirt.
- C. Placing the calculator or adding machine in an oven to evaporate all possible moisture.
- D. Lubricating the calculator or adding machine with a light oil.
- E. Replacing all defective parts with conventional or special tools as indicated in the service manual.
- F. Lubricating the parts to specifications indicated in the service manual.
- G. Operating the calculator or adding machine to determine performance.

**Verbal Learning:**

**Communication:**

- A. Interpreting directions on cleaning solutions for proper mixing.
- B. Interpreting instructions from the service manual for check points on calculators and adding machines.

**Measurement:**

- A. Measuring liquids in ounces, pints, quarts, and gallons.

**Science:**

- A. Recognizing the flammable and explosive properties of cleaning solution.

**General Information**

- A. Selecting the proper type of solution for cleaning business machines.

- B. Recognizing the various parts of calculators and adding machines.
- C. Practicing safety precautions noted in the service manual.
- D. Explaining the basic operation of calculators and adding machines.
- E. Explaining the function and movement of each part of calculators and adding machines.
- F. Selecting the proper type and size of screwdrivers, pliers, wrenches, cutters, nutdrivers.
- G. Applying the proper care, maintenance and storage of tools.
- H. Recognizing the proper methods of holding wrenches.
- I. Applying the proper methods of holding the work.
- J. Applying methods of holding pliers for pulling, pressing and twisting.
- K. Recognizing the results of using pliers for removing nuts and bolts.
- L. Applying the proper procedures for cutting with diagonal cutters.
- M. Determining the proper methods of stripping wire.
- N. Recognizing the various types of fastening devices.
- O. Recognizing the various types, uses and characteristics of threaded fasteners.
- P. Recognizing the various types and uses of washers.
- Q. Applying the proper methods of installing threaded fasteners.
- R. Recognizing the difference between right and left hand threads.

#### Suggested Student Activities

All student activities should be made practical and meaningful as possible. The use of actual business machines may assist in this process.

- A. Selecting and replacing defective or worn-out parts and making the necessary adjustments in connection with these replacements by following diagrams and instructions in the service manual.
- B. Replacing and aligning type on calculators and adding machines.
- C. Cleaning and washing calculating and adding machines and parts.
- D. Routine servicing and lubrication of calculators and adding machines.

- E. Testing power driven machines for operational faults and making necessary corrective adjustments.
- F. Checking reassembled manually operated machines and making corrective adjustments.

### Unit III

**Title:** Occupational Information Pertaining to Business Machine Servicing and Related Occupations.

**Objective:** To acquaint the individual with the opportunities in business machine servicing and related occupations.

#### Occupational Information

Obtaining information about:

- A. The employment outlook.
- B. The wage scale.
- C. The types of training available.
- D. The working conditions experienced in the occupation.
- E. The physical and mental characteristics needed for qualification for employment.
- F. The geographical location of employment.
- G. The opportunities for advancement.
- H. The advantages and disadvantages of the occupation.
- I. The nature of the work involved in the occupation.
- J. The union involvement in the occupation.
- K. The means of entry into the occupation.

Suggested Student Activities

All student activities should be made practical and meaningful as possible. The use of actual business machines may assist in this process.

- A. Writing specific information concerning opportunities in the occupations of the electro-mechanical installation and repair cluster.
- B. Visiting an office of the State Employment Service.
- C. Listening to a speaker from a trade union.
- D. Writing letters to correspondence and trade schools in order to determine opportunities for additional training.
- E. Visiting a school for apprentices.
- F. Visiting a business machine repair shop.
- G. Reading the Occupational Outlook Handbook.

INSTRUCTIONAL MATERIALS FOR BUSINESS MACHINE SERVICING

TYPE	TITLE	DESCRIPTION	SOURCE
Book	<u>Typewriter Mechanical Training Manual</u> by Clarence LeRoy Jones	The text covers mechanical typewriter care and service	Ames Supply Co.
Book	<u>Know Your Typewriter</u> by Eugene L. Dahl	The text covers fundamentals of care, maintenance and repair of typewriters	Superintendent of Documents
Book	<u>Typewriter Care</u> by Alfred H. Hausrath	The text covers typewriter care	Superintendent of Documents
Pamphlet	<u>Mechanical Instructions</u>	Pamphlet covers mechanical functions of the Remington Rand business machines	Remington Rand, Inc.
Manual	Parts Catalog and Service Data	Manual is a parts catalog of R.C. Allen Business Machines	R.C. Allen Business Machines, Inc.
Manual	Royal Standard Machine Adjustment Manual	Manual covers the adjustment of Royal typewriters	Royal Typewriter Co.
Manual	Service Engineering Manual	Manual covers the service of Smith-Corona business machines	Smith-Corona, Inc.
Manual	Underwood Typewriter Adjustment Manual	Manual covers the adjustment of Underwood typewriters	Underwood Corporation

**LEVEL I EXPERIENCES**  
**FIRST YEAR PROGRAM**

Unit I

**Title:** Determining the Cause and Locating the Trouble in the Small Home Appliance.

**Objective:** To develop in the individual the capability for observing the symptoms and isolating the defective components in the small appliances.

Manual or Manipulative Learning:

- A. Operating the appliance in order to observe the malfunction.
- B. Visually inspecting for obvious electrical or mechanical defects in the appliance.
- C. Visually inspecting for obvious defects in the cord and plug on the appliance.
- D. Connecting electrical meters in the proper manner.
- E. Inspecting the electrical components with the appropriate electrical meters.
- F. Determining voltage and resistance in the appliance with a volt-ohm meter.
- G. Visually inspecting for defective accessories on the appliance.
- H. Cleaning dirty components with a small brush.

Verbal Learning:

Communication:

- A. Interpreting the customer's complaint concerning the malfunction of the appliance.
- B. Writing the malfunctions of the appliance on a service ticket.
- C. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- D. Reading the manufacturer's service reference chart for the possible cause of trouble.
- E. Interpreting meter readings to determine the condition of the components.
- F. Interpreting instructions and information located on the data plate of the unit.

Mathematics:

- A. Computing Ohm's Law to determine amperage, voltage and resistance.

- A. Explaining the electron theory of current flow in the appliance.
- B. Explaining the characteristics of series and parallel circuits in the appliance.

### General Information

- A. Explaining the basic operation of the appliance.
- B. Applying the proper safety precautions:
  - a. wearing safety shoes with non-conducting soles
  - b. removing jewelry and items of clothing containing metal fasteners
  - c. avoiding work situations where moisture is present
  - d. disconnecting the appliance from the power supply before starting repair operations
  - e. properly grounding the appliance
- C. Recognizing the importance of proper connection of appropriate electrical meters.
- D. Selecting the appropriate electrical meter for the job to be done:
  - E. voltmeter, amp-meter or amp probe, continuity tester, volt-ohm meter.
  - F. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.
- G. Applying the proper procedure for diagnosing incorrect operation.
- H. Applying the proper methods of checking for electrical grounds.
- I. Applying the proper procedures of tracing electrical circuits.

### Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of actual appliances may assist in this process.

- A. Checking heating elements with an ohm meter.
- B. Testing circuits with continuity tester or ohm meter.
- C. Wiring dry cells in "series" and "parallel" circuits.
- D. Identifying parts of the appliance from drawings and schematics.

- E. Calculating the amount of current flow in an appliance using Ohm's Law.**
- F. Identifying defects in the appliance by checking trouble points noted in service manual.**

UNIT II

**Title:** Introductory Exercises in the Servicing of Small Appliances.

**Objective:** To develop in the individual the capability for disassembling and reassembling small appliances.

Manual or Manipulative Learning:

- A. Removing fasteners and cover plates of the appliance with the appropriate tools.
- B. Replacing fasteners and cover places with the appropriate tools.
- C. Cleaning all dirty components with a small brush.
- D. Dressing contacts on plug-in type elements with abrasive cloth.
- E. Applying lubricant on linkage and levers of the appliance.
- F. Removing soldered connections with a soldering iron.

Verbal Learning:

Communication:

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

General Information

- A. Selecting the proper type and size of tools for the job to be done:
  - B. screwdrivers, wrenches, pliers, cutters, nutdrivers.
  - C. Recognizing the proper method of holding hand tools.
  - D. Applying the proper method of holding work.
  - E. Recognizing the results of using pliers for removing nuts and bolts.
  - F. Applying the proper procedures for cutting with diagonal cutters.
  - G. Determining the proper care, maintenance and storage of tools.

- G. Recognizing the various types of fastening devices.
- H. Recognizing the various types and uses of washers.
- I. Applying the proper methods of installing threaded fasteners.
- J. Recognizing the difference between right and left-hand threads.
- K. Applying the proper safety precautions:
  - a. wearing safety shoes with non-conducting soles
  - b. removing jewelry and items of clothing containing metal fasteners
  - c. avoiding work situations where moisture is present
  - d. disconnecting the appliance from the power supply before starting repair operations
- L. Applying the proper methods of checking for electrical grounds.
- M. Recognizing the various parts of the appliance.
- N. Applying the methods of holding pliers for pulling, pressing and twisting.
- O. Determining the proper methods of stripping wire.
- P. Explaining the importance of observing recommended procedures when tightening down plates, covers, and flanges.
- Q. Selecting the proper types, sizes, and tips of soldering irons.
- R. Recognizing the importance of tinning the tip of the soldering iron.
- S. Recognizing the importance and purposes of flux when soldering.
- T. Applying the proper methods of transferring heat to work.
- U. Selecting the correct solders and fluxes to use on the appliance.

#### Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of actual appliances may assist in this process.

- A. Disassembling appliances such as: irons, toasters, waffle bakers, coffee makers, food mixers, blenders, fans and blowers, with appropriate tools.
- B. Reading schematics, service manuals and handbooks and tracing the electrical circuits in the appliance.
- C. Removing mechanical fasteners and soldered connections with the appropriate tools.

Unit III

**Title:** Replacing and Repairing the Defective Parts of Small Appliances.

**Objective:** To develop in the individual the capability for recognizing, repairing, and replacing the defective parts of small appliances.

**Manual or Manipulative Learning:**

- A. Replacing all damaged or broken components with the appropriate tools.
- B. Tying underwriters knot when replacing a plug.
- C. Repairing breaks in open-type coils with solderless connections and crimping pliers.
- D. Cleaning all dirty components with a small brush.
- E. Dressing the contacts on plug-in type elements with abrasive cloth.
- F. Soldering wires and electrical connections with a soldering iron.

**Verbal Learning:**

**Communication:**

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**Mathematics:**

- A. Computing Ohm's Law to determine amperage, voltage, and resistance.

**Science:**

- A. Explaining the characteristics of series and parallel circuits used in the appliance.

**General Information**

- A. Selecting the proper type heating elements for a particular appliance.

- B. Identifying different types, purposes, and uses of terminal blocks.
- C. Recognizing the proper methods of mounting and wiring heating elements.
- D. Recognizing the necessity of setting range surface heating elements level and flat.
- E. Recognizing the importance of even stretching when installing open type heating elements.
- F. Selecting the proper type and size of screwdriver, pliers, wrenches, cutters, nutdrivers.
- G. Applying the proper care, maintenance and storage of tools.
- H. Recognizing the proper methods of holding wrenches.
- I. Applying the proper methods of holding work.
- J. Applying the proper methods of holding pliers for pulling, pressing and twisting.
- K. Recognizing the results of using pliers for removing nuts and bolts.
- L. Applying the proper procedures for cutting with diagonal cutters.
- M. Determining the proper methods of stripping wire.
- N. Recognizing the various types of fastening devices.
- O. Recognizing the various types, uses and characteristics of threaded fasteners.
- P. Recognizing the various types and uses of washers.
- Q. Applying the proper methods of installing threaded fasteners.
- R. Recognizing the difference between right and left-hand threads.
- S. Applying the proper safety precautions:
  - a. wearing safety shoes with non-conducting soles
  - b. removing jewelry and items of clothing containing metal fasteners.
  - c. avoiding work situations where moisture is present
  - d. disconnecting the appliance from the power supply before starting repair operations
  - e. properly grounding the appliance when tightening down plates, covers and flanges
- T. Selecting the proper type, size and tips of soldering irons.
- U. Recognizing the importance of tinning the tip of the soldering iron.
- V. Recognizing the importance and purposes of flux when soldering.
- W. Applying the proper method of transferring heat to work.
- X. Selecting the correct solder and flux to use on the appliance.

Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of actual appliances may assist in this process.

- A. Tying an underwriters knot and replacing a cord and plug on an appliance.
- B. Making soldered connections with a soldering iron or soldering gun.
- C. Making solderless connections with "wire nuts."
- D. Removing and replacing components indicated by drawings with the appropriate tools.
- E. Connecting components in series and parallel circuits as indicated by the schematic.

Unit IV

**Title:** Testing and Adjusting Small Appliances for Maximum Performance.

**Objectives:** To develop in the individual the capability for testing and adjusting small appliances for maximum performance.

Manual or Manipulative Learning:

- A. Determining voltage and resistance in the appliance with a volt-ohm meter.
- B. Inspecting the appliance for defects with a continuity tester or the appropriate electrical meters.
- C. Connecting electrical meters in the proper manner.
- D. Operating the appliance to determine performance.

Verbal Learning:

Communication:

- A. Interpreting meter readings to determine the condition of components.
- B. Interpreting instructions from the service manual for check points.
- C. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

Mathematics:

- A. Computing Ohm's Law to determine amperage, voltage and resistance.

Science:

- A. Explaining the function of conductors and insulators.
- B. Explaining the various methods of heat transfer (conduction, connection, radiation.)
- C. Explaining the characteristics of series and parallel circuits.

General Information

- A. Inspecting the electrical components with the appropriate electrical meter.
- B. Recognizing the importance of proper connection of the appropriate electrical meters.
- C. Selecting the appropriate electrical meters for the job to be done: (voltmeter, amp-meter or amp-probe, continuity tester, volt-ohm meter).
- D. Applying the proper care, maintenance and storage of electrical meters.
- E. Determining the correct method of inspecting, checking, and calibrating electrical meters to known standards.
- F. Explaining the basic operation of the appliance.

Suggested Student Activities

All student activities should be made as practical and as meaningful as possible. The use of actual appliances may assist in this process.

- A. Checking the heating element with an ohmeter to determine its condition.
- B. Locating bad connections in the appliance with a voltmeter.
- C. Inspecting the insulators for cracks or breaks.
- D. Connecting the voltmeter and ammeter in the appliance circuit to determine the voltage and current flow.
- E. Computing the resistance from the measured voltage and current flow.
- F. Applying the power formula to determine wattage and compare it to the specifications.

HOME APPLIANCE SERVICING EXPERIENCES -- LEVEL I

Unit V

**Title:** Occupational Information Pertaining to Home Appliance Servicing and Related Occupations.

**Objective:** To acquaint the individual with the opportunities in home appliance servicing and related occupations.

Occupational Information

Obtaining information about:

- A. The employment outlook.
- B. The wage scale.
- C. The types of training available.
- D. The working conditions experienced in the occupation.
- E. The physical and mental characteristics needed for qualification for employment.
- F. The geographical location of employment.
- G. The opportunities for advancement.
- H. The advantages and disadvantages of the occupation.
- I. The nature of the work involved in the occupation.
- J. The union involvement in the occupation.
- K. The means of entry into the occupation.

Suggested Student Activities

- A. Writing specific information concerning opportunities in the occupations of the electro-mechanical installation and repair cluster.
- B. Visiting an office of the State Employment Service.
- C. Listening to a speaker from a trade union.
- D. Writing letters to correspondence and trade schools in order to determine opportunities for additional training.
- E. Visiting a school for apprentices.
- F. Visiting an appliance service center.
- G. Reading the Occupational Outlook Handbook.

**LEVEL II EXPERIENCES**  
**SECOND YEAR PROGRAM**

## Unit 1

**Title:** Installation of Major Home Appliances.

**Objective:** To develop in the individual the capability for installing, testing, and explaining the operation of major home appliances.

**Manual or Manipulative Learning:**

- A. Connecting the receptacle to the power line with a screwdriver.
- B. Connecting a pigtail to an appliance with a screwdriver.
- C. Connecting electrical meters in the proper manner to determine if there is sufficient electrical power to operate the appliance.
- D. Installing the vent system for an automatic dryer in the home.
- E. Cutting a hole in wood, plaster, brick, or concrete for mounting an exhaust hood through the floor or outside wall with the appropriate tools.
- F. Installing the water hoses and drain hoses to the washing machine with water pump pliers.
- G. Connecting a ground to an appliance with a screwdriver and pliers.
- H. Plugging the line cord into the receptacle.
- I. Leveling the appliance for maximum performance with a level.

**Verbal Learning:**

**Communication:**

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics, and handbooks.
- B. Interpreting instructions and information located on the data plate of the unit.
- C. Interpreting meter readings to determine electrical values at the service outlet.
- D. Interpreting the instruction manuals concerning the operating procedures of the appliances.
- E. Explaining operation of the controls, and accessories of the appliances to the customer.
- F. Explaining the importance and method of cleaning the lint trap of an automatic dryer to the customer.
- G. Explaining the methods of protecting the finish of the appliance to the customer.

J. Manually operating the controls and timing devices of the appliances while checking for proper operation or demonstrating the appliance to the customer.

Measurement:

- A. Measuring voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.
- B. Measuring current at the service outlet with an amp-probe to determine the amount of current available for the appliance.
- C. Measuring the length and width of material with a steel tape.

General Information

- A. Following safety procedures when working with live circuits.
- B. Preventing damage to finished surfaces when installing major appliances.
- C. Recognizing the importance of the proper connection of the appropriate electrical meters.
- D. Selecting the appropriate electrical meters for the job to be done (voltmeter, amp-meter or amp-probe, continuity tester, volt-ohm meter).
- E. Applying the proper care, maintenance and storage of electrical meters.
- F. Determining the correct method of inspecting, checking, and calibrating electrical meters to known standards.
- G. Recognizing the importance of following the electrical codes.
- H. Recognizing the importance of checking for water and oil leaks.
- I. Determining the type of vent necessary based on dryer location.
- J. Explaining the operation of the various types of ranges (conventional, built-in, table-top).
- K. Selecting the proper type and size of screwdrivers, pliers, wrenches, cutters, nutdrivers, hammers, punches, chisels, levels.
- L. Applying the proper care, maintenance and storage of tools.
- M. Recognizing the proper methods of holding wrenches.
- N. Applying the proper methods of holding the work.
- O. Applying methods of holding pliers for pulling, pressing, and twisting.

- P. Recognizing the results of using pliers for removing nuts and bolts.
- Q. Applying the proper procedures for cutting with diagonal cutters.
- R. Determining the proper methods of stripping wire.
- S. Recognizing the various types of fastening devices.
- T. Recognizing the various types, uses and characteristics of threaded fasteners.
- U. Recognizing the various types and uses of washers.
- V. Applying the proper methods of installing threaded fasteners.
- W. Recognizing the difference between right and left hand threads.
- X. Applying the proper safety precautions:
  - a. wearing safety shoes with non-conducting soles
  - b. removing jewelry and items of clothing containing metal fasteners
  - c. avoiding work situations where moisture is present
  - d. properly grounding the appliance

#### Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of actual appliances may assist in this process.

- A. Installing a vent system for an automatic dryer following the manufacturer's instructions.
- B. Measuring and cutting hoses for home appliances to the specified length.
- C. Installing the following major home appliances: automatic washers, dryers, electric ranges, refrigerators.
- D. Demonstrating the use and explaining the operation of the major home appliances.
- E. Measuring the electrical power at the service outlet with the appropriate meters.
- F. Calculating the amount of current flow in an appliance using Ohm's Law.

## Unit II

**Title:** Determining the Cause and Locating the Trouble in the Major Home Appliances.

**Objective:** To develop in the individual the capability for observing the symptoms and isolating the defective components in the major home appliances.

**Manual or Manipulative Learning:**

- A. Operating the appliance in order to observe the malfunction.
- B. Visually inspecting for obvious electrical or mechanical defects in the appliance.
- C. Visually inspecting for obvious defects in the cord and plug on the appliance.
- D. Connecting electrical meters in the proper manner.
- E. Inspecting the electrical components with the appropriate electrical meters to locate the defective section.
- F. Inspecting the water supply for leaks and correct pressure.
- G. Visually inspecting the appliances for oil or water leaks.
- H. Visually inspecting the appliance cabinets for broken welds, rattles, dents, chipped paint and other obvious defects.
- I. Inspecting the electrical devices of the appliance with the appropriate electrical meters and eliminating the possible causes of trouble until the particular defective section is found.

**Verbal Learning:**

**Communication:**

- A. Interpreting the customer's complaint concerning the malfunction of the appliance.
- B. Writing the malfunctions of the appliance on a service ticket.
- C. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- D. Interpreting instructions and information located on the data plate of the unit.
- E. Reading the manufacturer's service reference chart for the possible cause of trouble.
- F. Interpreting meter readings to determine the condition of the components.
- G. Interpreting gauges to determine the depth and duration of vacuum necessary in a refrigerator as indicated in the specifications.

- J. Inspecting temperature setting devices
  - K. Inspecting the motor of the appliances for proper operation.
  - L. Inspecting the air circulation system of the automatic dryer for proper operation.
  - M. Inspecting the home electrical supply with the appropriate electrical meters.
  - N. Visually inspecting the refrigerant tubing for damage or wear (kinks, nicks, breaks).
  - O. Checking the temperature inside the refrigerator with a recording thermometer.
  - P. Inspecting door gasket seals on appliances for tightness.
  - Q. Inspecting the refrigerant tubing for leaks with a halide leak detector.

Mathematics:

- A. Computing Ohm's Law to determine amperage, voltage and resistance.
- B. Calculating the amount of refrigerant needed in the lines of the refrigerator.

Measurement:

- A. Measuring voltage at the service outlet with a voltmeter to determine the amount of voltage for the appliance.
- B. Measuring current at the service outlet with an amp-probe to determine the amount of current available for the appliance.
- C. Measuring the amount of refrigerant in the system of a refrigerator with a pressure gauge.

Science:

- A. Explaining the electron theory of current flow in the appliance.
- B. Explaining the characteristics of series and parallel circuits used in the appliance.

General Information

- A. Explaining the basic operation of the major home appliances.
- B. Applying the proper methods of checking for electrical grounds.
- C. Applying the proper procedure for tracing electrical circuits.
- D. Recognizing the various parts of the appliances.
- E. Recognizing the methods of water extraction used in automatic washers (centrifugal force, vacuum-collapsed tubs).
- F. Recognizing the importance of checking for water leaks at all connections.
- G. Analyzing the causes of poor drying in an automatic dryer (humidity, venting, moisture).

- H. Applying the proper procedure for diagnosing malfunctions or incorrect operation.
- I. Applying the proper methods of using a halide leak detector and interpreting the results.
- J. Recognizing the various types, purposes, and functions of switches and automatic controls used in electric ranges.
- K. Applying the proper methods of checking and adjusting temperatures when servicing an electric range.
- L. Recognizing the various types, and the importance of proper lubrication of hinges and counter-balances used on appliances.
- M. Recognizing the importance of the proper connection of the appropriate electrical meters.
- N. Selecting the appropriate electrical meters for the job to be done (voltmeter, amp-meter or amp-probe, continuity tester, volt-ohm meter).
- O. Applying the proper care, maintenance and storage of electrical meters.
- P. Determining the correct method of inspecting, checking, and calibrating electrical meters to known standards.
- Q. Applying the proper safety precautions:
  - a. wearing safety shoes with non-conducting soles
  - b. removing jewelry and items of clothing containing metal fasteners
  - c. avoiding work situations where moisture is present
  - d. disconnecting the appliance from the power supply before starting repair operations
  - e. properly grounding the appliance

Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of actual appliances may assist in this process.

- A. Identifying the defects in major home appliances by checking trouble points noted in the service manual.
- B. Inspecting the electrical system of the home and the appliance with the appropriate electrical meters.
- C. Testing timers, escapement mechanisms, solenoids, valves, clutches, motors, compressors, and heating elements of major home appliances for defects.

- D. Identifying parts of the appliance from drawings and schematics.**
- E. Calculating the amount of current flow in an appliance using Ohm's Law.**

## Unit III

**Title:** Introductory Exercises in the Servicing of Major Home Appliances.

**Objective:** To develop in the individual the capability for disassembling and reassembling major home appliances.

**Manual or Manipulative Learning:**

- A. Removing and replacing fasteners and cover plates of the appliances with the appropriate tools.
- B. Applying penetrating oil or other fluids for freeing screws and fasteners.
- C. Cleaning all dirty components with recommended solvents, brush, and/or compressed air.
- D. Removing all gauges and manifolds from the system of a refrigerator before re-assembling.
- E. Removing and replacing the heating elements from the electric range with the appropriate tools.
- F. Removing and replacing the doors from appliances.
- G. Removing and replacing table-top range units from built-in cabinets with the appropriate tools.
- H. Cleaning terminals of heating elements for good contact with abrasive cloth.

**Verbal Learning:****Communication:**

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

**Communication:**

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

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- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

## General Information

- A. Recognizing the various parts of the appliances.
- B. Recognizing the mechanical advantage of wrenches.
- C. Recognizing the importance of correct fit of wrenches on the heads of nuts and bolts.
- D. Selecting the proper type and size of screwdrivers, pliers, wrenches, cutters, nutdrivers, hammers, punches, pullers, and chisels.
- E. Applying the proper care, maintenance and storage of tools.
- F. Recognizing the proper methods of holding wrenches.
- G. Applying the proper methods of holding the work.
- H. Applying methods of holding pliers for pulling, pressing and twisting.
- I. Recognizing the results of using pliers for removing nuts and bolts.
- J. Applying the proper procedures for cutting with diagonal cutters.
- K. Determining the proper methods of stripping wire.
- L. Recognizing the various types of fastening devices.
- M. Recognizing the various types, uses and characteristics of threaded fasteners.
- N. Recognizing the various types and uses of washers.
- O. Applying the proper methods of installing threaded fasteners.
- P. Recognizing the difference between right and left hand threads.
- Q. Explaining the importance of observing recommended procedures when tightening down plates, covers, and flanges.
- R. Selecting the proper types of solution for cleaning components.
- S. Selection of the proper types, sizes and tips of soldering irons.
- T. Selection of the proper types of tips for soldering irons.
- U. Recognizing the importance of tinning the tip of the soldering iron.
- V. Recognizing the importance and purposes of flux when soldering.
- W. Applying the proper method of transferring heat to work.
- X. Selecting the correct solder and fluxes to use on the appliance.

**V. Applying the proper safety precautions:**

- a. wearing safety shoes with non-conducting soles
- b. removing jewelry and items of clothing containing metal fasteners
- c. avoiding work situations where moisture is present
- d. disconnecting the appliance from the power supply before starting repair operations
- e. properly grounding the appliance
- f. wearing protective clothing when working with cleaning agents and solvents
- g. applying proper ventilating procedures when working with cleaning agents and solvents

**Suggested Student Activities**

All student activities should be made as practical and meaningful as possible. The use of actual appliances may assist in this process.

- A. Disassembling appliances such as automatic washers, dryers, electric ranges, and refrigerators following instructions indicated by the service manuals.
- B. Reading schematics, service manuals, handbooks, and tracing the electrical circuits in the appliance.
- C. Removing mechanical fasteners and soldered connections with the appropriate tools.
- D. Identifying parts of the appliance from drawings and schematics.
- E. Cleaning dirty components with solvents, brush, and/or compressed air.
- F. Reassembling the appliance to its original condition.

Unit IV

**Title:** Replacing and Repairing the Defective Parts of the Major Home Appliance.

**Objective:** To develop in the individual the capability for recognizing, repairing, and replacing the defective parts of the major home appliances.

**Manual or Manipulative Learning:**

- A. Disconnecting all electrical connections to the defective parts with the appropriate tools.
- B. Removing and replacing all mechanical fasteners with the appropriate tools.
- C. Installing the new parts in the same position as the defective part previously removed with the appropriate tools.
- D. Rewiring the electrical connections with the appropriate tools.
- E. Applying lubricant on linkage and levers of the appliances.
- F. Repairing broken wires, replacing loose or broken fastening devices, cleaning or tightening switch contacts with the appropriate tools.
- G. Cleaning all dirty components with the appropriate cleaning agents or solvents.
- H. Applying penetrating oil or other fluids for freeing screws and fasteners.
- I. Charging the refrigerator system with the specified refrigerant.

**Verbal Learning:**

**Communication:**

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- B. Interpreting gauges to determine the depth and duration of vacuum necessary in a refrigerator as indicated in the specifications.

**Measurement:**

- A. Measuring tolerances and clearances with feeler gauges.
- B. Measuring the amount of refrigerant in the system of a refrigerator with a pressure gauge.

**Mathematics:**

- A. Calculating the amount of torque required to tighten threaded fasteners.
- B. Computing Ohm's Law to determine amperage, voltage and resistance.

- J. Removing and replacing all components found defective in the major home appliance with the appropriate tools.
- K. Demonstrating the procedure of using vacuum pumps to remove contaminants from the system of a refrigerator.
- L. Repairing hinges and counterbalances on the doors of the major home appliances.
- M. Rewiring the oven unit of an electric range with the appropriate tools.
- N. Repairing broken wires with solderless connections and crimping tool.
- O. Cleaning and tightening switch contacts with abrasive cloth and a screwdriver.
- C. Calculating the amount of refrigerant needed in the lines of the refrigerator.

Science:

- A. Explaining the characteristics of series and parallel circuits used in the major home appliances.
- B. Explaining the electron theory of current flow in the appliance.

General Information

- A. Selecting the proper lubricant necessary for the moving parts of the appliance.
- B. Recognizing the various parts of the major home appliances.
- C. Recognizing the possibility of repairing the defective part of the appliance in the home.
- D. Recognizing that repairs requiring extensive power tools should be done in the shop.
- E. Recognizing the proper types of solvents and cleaning agents needed for cleaning parts.
- F. Selecting the proper methods of repairing, replacing, and/or servicing the mechanical and electrical components and assemblies of the major home appliances.
- G. Recognizing the various methods of water extraction used in automatic washers.
- H. Recognizing the different types of refrigerants used in refrigerators.
- I. Explaining the effects of contaminants in the refrigerator system.
- J. Applying the proper safety precautions when working with refrigerants.

- K. Recognizing the importance and proper method of proper electrical connections in all major home appliances.
- L. Applying the proper method of checking and adjusting temperatures in the appropriate major home appliances.
- M. Selecting the proper type and size of screwdrivers, pliers, wrenches, cutters, nutdrivers, hammers, punches, chisels, and levels.
- N. Applying the proper care, maintenance and storage of tools.
- O. Recognizing the proper methods of holding wrenches.
- P. Applying the proper methods of holding the work.
- Q. Applying methods of holding pliers for pulling, pressing and twisting.
- R. Recognizing the results of using pliers for removing nuts and bolts.
- S. Applying the proper procedures for cutting with diagonal cutters.
- T. Determining the proper methods of stripping wire.
- U. Recognizing the various types of fastening devices.
- V. Recognizing the various types, uses and characteristics of threaded fasteners.
- W. Recognizing the various types and uses of washers.
- X. Applying the proper methods of installing threaded fasteners.
- Y. Recognizing the difference between right and left hand threads.
- Z. Explaining the importance of observing recommended procedures when tightening down plates, covers, and flanges.
- AA. Selecting the proper types of solution for cleaning components.
- AB. Selection of the proper types, sizes and tips of soldering irons.
- AC. Selection of the proper types of tips for soldering irons.
- AD. Recognizing the importance of tinning the tip of the soldering iron.
- AE. Recognizing the importance and purposes of flux when soldering.
- AF. Applying the proper method of transferring heat to work.
- AG. Selecting the correct solder and fluxes to use on the appliances.

**AH. Applying the proper safety precautions:**

- a. wearing safety shoes with non-conducting soles
- b. removing jewelry and items of clothing containing metal fasteners
- c. avoiding work situations where moisture is present
- d. disconnecting the appliance from the power supply before starting repair operations
- e. properly grounding the appliance
- f. wearing protective clothing when working with cleaning agents and solvents
- g. applying proper ventilating procedures when working with cleaning agents and solvents
- AI. Recognizing the proper types, uses and methods of repairing pumps used in the major home appliances.
- AJ. Applying the proper methods and procedures in repairing drive mechanisms used in the major home appliances.
- AK. Applying the proper methods of repairing motors used in the major home appliances.
- AL. Recognizing the types, function and method of repairing and/or replacing timers, switches and overload devices used in the major home appliances.
- AM. Applying the proper methods and procedures for installing keys, springs, pins, and retaining rings.

**Suggested Student Activities**

All student activities should be made as practical and meaningful as possible. The use of actual appliances may assist in this process.

- A. Tying an underwriters knot and replacing a cord and plug on an appliance.
- B. Removing mechanical fasteners and soldered connections with the appropriate tools.
- C. Installing new parts in place of defective components in an appliance with the appropriate tools, and following instructions indicated by the service manual.
- D. Repairing broken electrical connections with soldering iron or solderless connections.

- E. Removing contaminants and charging a refrigerator system according to information on the data plate and the service manual.
- F. Calculating the amount of refrigerant needed in the lines of a refrigerator.
- G. Rewiring the oven unit of an electric range.

## Unit V

**Title:** Testing and Adjusting the Major Home Appliances for Maximum Performance.

**Objective:** To develop in the individual the capability for testing and adjusting the major home appliances for maximum performance.

**Manual or Manipulative Learning:**

- A. Checking all connections and mountings after making a repair or replacing a part.
- B. Observing the operation of the new or repaired part for proper function and for excessive vibration.
- C. Adjusting the appliance and any components found malfunctioning for optimum performance.
- D. Operating manually the controls to start the major home appliances.
- E. Observing the operation of the appliance through complete cycles, noting the accuracy of the timing mechanism.
- F. Adjusting the temperature control settings to weather conditions in a refrigerator.
- G. Testing the refrigerator for proper temperature over a 72-hour period with a recording thermometer.
- H. Testing a selected temperature range with a pyrometer.
- I. Adjusting the doors of the major home appliances for proper closure.

**Verbal Learning:**

**Communication:**

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- B. Reading the recording thermometer to determine the performance of a refrigerator over a period of time.

**Measurement:**

- A. Measuring the temperature cycling intervals of a refrigerator.

- B. Adjusting the doors of the major home appliances for proper closure.

### General Information

- A. Recognizing that incorrect wiring may blow a fuse or burn up a part.
- B. Recognizing that loose or incorrect mounting may cause breakage of parts.
- C. Explaining the basic operation of all the major home appliances.
- D. Explaining the effects of incorrect temperatures in an automatic dryer.
- E. Recognizing the importance of proper connections of heating elements in an electric range.

### Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of actual appliances may assist in this process.

- A. Checking all electrical connections with the appropriate electrical meters.
- B. "Fast cycling" the appropriate appliances following instructions in the service manual, to observe the accuracy of the timer mechanism.
- C. Operating the appliance and observing the performance.
- D. Testing the refrigerator with a recording thermometer.
- E. Adjusting the doors of the major home appliance for proper closure.

## Unit VI

**Title:** Occupational Information Pertaining to Home Appliance Servicing and Related Occupations.

**Objective:** To acquaint the individual with the opportunities in home appliance servicing and related occupations.

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Occupational Information

Obtaining information about:

- A. The employment outlook.
- B. The wage scale.
- C. The types of training available.
- D. The working conditions experienced in the occupation.
- E. The physical and mental characteristics needed for qualification for employment.
- F. The geographical location of employment.
- G. The opportunities for advancement.
- H. The advantages and disadvantages of the occupation.
- I. The nature of the work involved in the occupation.
- J. The union involvement in the occupation.
- K. The means of entry into the occupation.

Suggested Student Activities

- A. Writing specific information concerning opportunities in the occupations of the electro-mechanical installation and repair cluster.
- B. Visiting an office of the State Employment Service.
- C. Listening to a speaker from a trade union.
- D. Writing letters to correspondence and trade schools in order to determine opportunities for additional training.
- E. Visiting a school for apprentices.
- F. Visiting an appliance service center.
- G. Reading the Occupational Outlook Handbook.

## INSTRUCTIONAL MATERIALS FOR HOME APPLIANCE SERVICING

TYPE	TITLE	DESCRIPTION	SOURCE
Book	<u>How To Repair Major Home Appliances</u> by Ernest Tricomi	Servicing guide on the installation, operation, and repair of all types of major appliances.	Howard W. Sams & Co.
Book	<u>Major Appliance Servicing</u> by Percy T. Brockwell, Jr.	Book explains how to repair and recondition major appliances.	McGraw-Hill Book Co.
Book	<u>Small Appliance Servicing</u> by Percy T. Brockwell, Jr.	Professional small appliance servicing techniques are shown.	McGraw-Hill Book Co.
Book	<u>How To Repair, Small Appliances</u> by Jack Darr	Book includes valuable tips about line cords and plugs, heating elements, obtaining parts, and tools needed to repair appliances.	Howard W. Sams & Co.
Book	<u>How To Repair Electrical Appliances</u> by H. P. Manly	Book includes information about trouble-shooting, adjustment, repair, and maintenance of household appliances	Frederick J. Drake & Co.
Book	<u>Electrical Appliance Servicing Training Study Texts</u>	Study texts cover basic electricity, all types of household appliances, and electrical wiring	National Radio Institute

Film	<b>Elements of Electrical Circuits</b>	Film describes nature of electric currents and circuits. 11 min. B & W.	Encyclopaedia Britannica Films, Inc.
Film	<b>Principles of Electricity</b>	Film explains the structure of matter and the action of electrons. 20 min. color	General Electric Co.
Film	<b>Series and Parallel Circuits</b>	Film explains the differences between these types of circuits. 11 min. B & W.	Encyclopaedia Britannica Films, Inc.
Training Guide	<b>Automatic Washer Training Guide</b>	Guide has a brief outline of how the washer is constructed, operates and serviced	Norge, No. 33-1190
Handbook	<b>National Electrical Code Handbook</b>	Book covers codes for electrical installation. \$12.00	McGraw-Hill Book Co.

**LEVEL I EXPERIENCES**  
**FIRST YEAR PROGRAM**

Unit I

**Title:** Observing the Symptoms to Determine the Defective Stage of the Radio.

**Objective:** To develop in the individual the capability for determining the defective stage of a radio from the symptoms.

**Manual or Manipulative Learning:**

- A. Recognizing obvious broken parts and leads of radio components.
- B. Listening to the performance of the radio to locate defects.
- C. Visually inspecting for obvious defects in the cord and plug on the radio.

**Verbal Learning:**

**Communication:**

- A. Reading a block diagram to follow the stages in the radio.
- B. Locating the different stages of the radio from the schematic diagram.

**Science:**

- A. Explaining the characteristics and functions of radio waves.

**General Information**

- A. Explaining the function of each stage of a radio.
- B. Applying the proper safety precautions:
  - a. wearing safety shoes with non-conducting soles
  - b. removing jewelry and items of clothing containing metal fasteners
  - c. avoiding work situations where moisture is present
  - d. properly grounding the radio

Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of an actual radio may assist in this process.

- A. Visually inspecting the radio for obvious broken components, wires, etc.
- B. Reading a block diagram and schematic to determine the location and value of components.
- C. Comparing the distance covered by sound waves and radio waves.

Unit II

**Title:** Checking the Tubes and Isolating the Defective Components in a Particular Stage of the Radio

**Objective:** To develop in the individual the capability of testing tubes and isolating defective components in a particular stage of the radio.

**Manual or Manipulative Learning:**

- A. Operating a tube tester to determine the condition of tubes.
- B. Straightening tube pins with a pin straightener to facilitate testing.
- C. Removing the tubes from a radio chassis by hand or with a tube puller.
- D. Testing for gassy tubes with a tube tester.
- E. Testing for shorts or open filaments with the tube tester.
- F. Injecting a signal in the proper sequence to isolate the defective stage with a signal generator.
- G. Connecting electrical meters in the proper manner.
- H. Checking the resistance in a particular stage of a radio with a volt-ohm meter.
- I. Inspecting the electrical components with the appropriate electrical meters to eliminate the possible cause of trouble until the defective component is found.

**Verbal Learning:**

**Communication:**

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- B. Reading the tube chart and tube-chart manual to determine the type and rating of the tube.
- C. Interpreting meter readings of the tube tester to determine the tube condition.
- D. Reading manufacturer's service reference charts for the possible cause of trouble.
- E. Reading the manufacturer's schematic to locate the components.
- F. Interpreting the meter readings to determine the condition of the components.

**Measurement:**

- A. Comparing the measured tube values with the specifications.

B. Measuring resistance, voltage and current flow in the different stages of the radio with the appropriate electrical meters.

Mathematics:

A. Computing Ohm's Law to determine amperage, voltage and resistance.

Science:

A. Explaining the electron theory of current flow in the radio.

B. Explaining the characteristics of series and parallel circuits used in the radio.

General Information

A. Recognizing the different types of tube testers.

B. Recognizing the different types of tube sockets by observation.

C. Recognizing the different types of tubes by observation.

D. Recognizing the various parts of the radio.

E. Recognizing the color code of resistors.

F. Explaining the function of each stage of the radio.

G. Recognizing the importance of the proper connection of appropriate electrical meters.

H. Selecting the appropriate electrical meter for the job to be done: (voltmeter, amp-meter or amp-probe, continuity tester, volt-ohm meter).

I. Applying the proper care, maintenance and storage of electrical meters.

J. Determining the correct method of inspecting, checking, and calibrating electrical meters to known standards.

K. Applying the proper safety precautions:

- wearing safety shoes with non-conducting soles
- removing jewelry and items of clothing containing metal fasteners
- avoiding work situations where moisture is present

- d. disconnecting the radio from the power supply before starting repair operations
- e. discharging the capacitors of the radio
- f. properly grounding the radio

Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of an actual radio may assist in this process.

- A. Operating a tube tester to determine the condition of the tubes.
- B. Working with Ohm's Law to determine voltage, resistance, and current flow.
- C. Tracing the circuits in a radio from a schematic, and identifying the components.
- D. Connecting the appropriate electrical meters in the radio circuits to measure values of voltage, current, and resistance.
- E. Injecting a signal in the radio circuits in the proper sequence to isolate the defective stage.

Unit III

**Title:** Removing the Chassis, Replacing the Defective Components and Replacing the Chassis in the Cabinet After Repairs Have Been Completed.

**Objective:** To develop in the individual the capability for removing a radio chassis from the cabinet, replacing the defective components and replacing the chassis after the repairs have been completed.

Manual or Manipulative Learning:

- A. Disconnecting the line cord from the wall receptable.
- B. Removing and replacing the knobs from the front of the cabinet.
- C. Unsoldering and resoldering the antenna leads from the built-in antenna with a soldering gun.
- D. Removing and replacing the fasteners holding the chassis to the cabinet using the appropriate tools.
- E. Riveting the tube sockets in place with a hand riveter.
- F. Removing and replacing the defective components from the chassis with a soldering gun and appropriate tools.
- G. Connecting the electrical meters in the proper manner.
- H. Replacing the defective cord and/or plug.

Verbal Learning:  
Communication:

- A. Reading manufacturer's schematic to find the disconnect point of the built-in antenna.
- B. Reading manufacturer's schematic to determine the values and location of components.

Measurement:

- A. Measuring the replacement components to determine correct values with the appropriate meters.

Science:

- A. Recognizing the corrosive effects of acid on copper.

## General Information

- A. Exercising care to prevent damage to components with heat when soldering.
- B. Practicing safe working procedures when soldering.
- C. Recognizing the importance of using only rosin core solder on electrical connections.
- D. Selecting the proper type and size of screwdrivers, cutters, nutdrivers, wrenches, pliers.
- E. Applying the proper care, maintenance and storage of tools.
- F. Applying the proper methods of holding work.
- G. Applying the methods of holding pliers for pulling, pressing, and twisting.
- H. Recognizing the results of using pliers for removing nuts and bolts.
- I. Applying the proper procedures for cutting with diagonal cutters.
- J. Determining the proper methods of stripping wire.
- K. Recognizing the importance of proper connection of appropriate electrical meters.
- L. Selecting the appropriate electrical meters for the job to be done: (voltmeter, amp-meter or amp-probe, continuity tester, volt-ohm meter).
- M. Applying the proper care, maintenance and storage of electrical meters.
- N. Determining the correct method of inspecting, checking, calibrating electrical meters to known standards.
- O. Arranging the parts in an orderly procedure to prevent loss or damage.
- P. Applying the proper safety precautions:
  - a. wearing safety shoes with non-conducting soles
  - b. removing jewelry and items of clothing containing metal fasteners
  - c. avoid work situations where moisture is present
  - d. disconnecting the appliance from the power supply before starting repair operations
  - e. discharging the capacitors of the radio
  - f. properly grounding the radio

- Q. Recognizing the various types of fastening devices.
- R. Recognizing the various types, uses, and characteristics of threaded fasteners.
- S. Recognizing the various types and uses of washers.
- T. Applying the proper methods of installing threaded fasteners.
- U. Recognizing the difference between right and left hand threads.
- V. Selecting the proper types, tips and size of soldering irons or soldering gun.
- W. Recognizing the importance of tinning the tip of the soldering iron or soldering gun.
- X. Recognizing the importance and purposes of flux when soldering.
- Y. Applying the proper method of transferring heat to work.
- Z. Selecting the correct solder and flux to use on the radio.

#### Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of an actual radio may assist in this process.

- A. Removing the chassis from the cabinet for ease of servicing.
- B. Unsoldering and resoldering the new components in place.
- C. Reading the schematic to determine the value and location of components.
- D. Determining the correct solder and flux for electrical connections.
- E. Riveting components in position with a riveter.
- F. Connecting the appropriate electrical meters in the proper manner to measure voltage, current and resistance.
- G. Replacing the chassis in the cabinet and reconnecting the built-in antenna with the appropriate tools.

#### Unit IV

**Title:** Making the Final Operational Checks and Adjustments to the Radio.

**Objective:** To develop in the individual the capability of making the final operational checks and adjustments to the radio

**Manual or Manipulative Learning:**

- A. Plugging the radio into the service outlet.
- B. Tuning the radio to a local station.
- C. Listening to the radio set on a selected frequency to determine performance.
- D. Checking for loose connection in the radio.
- E. Adjusting the trimmer condensors to peak output position with a screwdriver.

**General Information**

- A. Recognizing the correct operation of the radio from the audio signal.
- B. Selecting the proper type and size of screwdriver.
- C. Applying the proper care, maintenance and storage of tools.

**Suggested Student Activities**

All student activities should be made as practical and meaningful as possible. The use of a repaired radio may assist in this process.

- A. Making the final adjustments to a repaired radio.

Unit V

**Title:** Occupational Information Pertaining to Radio Servicing and Related Occupations.

**Objective:** To acquaint the individual with the opportunities in radio servicing and related occupations.

Occupational Information

Obtaining information about:

- A. The employment outlook.
- B. The wage scale.
- C. The types of training available.
- D. The working conditions experienced in the occupation.
- E. The physical and mental characteristics needed for qualification for employment.
- F. The geographical location of employment.
- G. The opportunities for advancement.
- H. The advantages and disadvantages of the occupation.
- I. The nature of the work involved in the occupation.
- J. The union involvement in the occupation.
- K. The means of entry into the occupation.

Suggested Student Activities

- A. Writing specific information concerning opportunities in the occupations of the electro-mechanical cluster.
- B. Visiting an office of the State Employment Service.
- C. Listening to a speaker from a trade union.
- D. Writing letters to correspondence and trade schools in order to determine opportunities for additional training.
- E. Visiting a school for apprentices.
- F. Visiting a radio service shop.
- G. Watching movies of electricity and radio fundamentals.
- H. Reading the Occupational Outlook Handbook.

**LEVEL II EXPERIENCES**  
**SECOND YEAR PROGRAM**

## TELEVISION SERVICING EXPERIENCES - - LEVEL II

### Unit I

**Title:** Determining the Defective Stage of the Television from Observation.

**Objective:** To develop in the individual the capability for determining the defective stage of a television from observation.

#### Manual or Manipulative Learning:

- A. Recognizing audio signal characteristics to localize the defect.
- B. Recognizing video signal characteristics to localize the defect.
- C. Determining the defective stage of a television by visual inspection.
- D. Visually inspecting for obvious defects in the cord and plug of the television.

#### Verbal Learning:

##### Communication:

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

#### General Information

- A. Explaining the characteristics and function of each stage of the television.

Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of an actual television set may assist in this process.

- A. Visually inspecting the television for obvious broken components, wires, etc.
- B. Reading a block diagram and schematic to determine the location and value of components.
- C. Identifying components of the television from drawings, schematics or service manuals.
- D. Identifying defects in the television by checking trouble points noted in the service manual.

**Unit II**

**Title:** Isolating the Defective Components and Checking the Tubes in the Suspected Stage of the Television.

**Objective:** To develop in the individual the capability for locating the defective stage and checking the tubes in a television.

**Manual or Manipulative Learning:**

- A. Operating a tube tester to determine the condition of tubes.
- B. Straightening tube pins with a pin straightener to facilitate testing.
- C. Removing the tubes from a television chassis with a tube puller or lifter.
- D. Testing for shorts or open filaments with a tube tester.
- E. Testing for gassy tubes with a tube tester.
- F. Checking the wave forms with an oscilloscope.
- G. Connecting the electrical meters in the proper manner.
- H. Inspecting the electrical components with the appropriate electrical meters to eliminate the possible cause of trouble until the defective component is found.

**Verbal Learning:**

**Communication:**

- A. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.
- B. Reading tube chart and tube manual to determine the type and rating of the tube.
- C. Reading manufacturer's service reference charts for possible cause of trouble.
- D. Reading manufacturer's schematics to locate the components.
- E. Interpreting the meter readings to determine the condition of the components.

**Mathematics:**

- A. Computing Ohm's Law to determine the amperage, voltage and resistance.

**Science:**

- A. Explaining the electron theory of current flow.

- A. Recognizing the different types of tubes by observation.
- B. Recognizing the different types of tube sockets by observation.
- C. Recognizing the different types of tube testers.
- D. Practicing safety precautions when working with live circuits.
- E. Identifying the different components and their designated values.
- F. Recognizing the importance of discharging capacitors and picture tube prior to using the Volt-Ohm meter in the circuit.
- G. Explaining the function of each stage of the television.
- H. Recognizing the importance of the proper connection of appropriate electrical meters.
- I. Selecting the appropriate electrical meter for the job to be done. (Voltmeter, Amp-meter or Amp-probe, continuity tester, Volt-Ohm meter).
- J. Applying the proper care, maintenance and storage of electrical meters.
- K. Determining the correct method of inspecting, checking and calibrating electrical meters to known standards.
- L. Recognizing the color code of resistors.

Suggested Student Activities

All student activities should be made as practical and meaningful as possible. This process may be accomplished by the use of an actual television.

- A. Operating a tube tester to determine the condition of the tubes.
- B. Calculating Ohm's Law to determine voltage, resistance, and current flow.
- C. Tracing the circuits in a television from a schematic, and identifying the components.
- D. Connecting the appropriate electrical meters in the television circuit to measure values of voltage, current and resistance.

Unit III

**Title:** The Removing and Replacement of Components in the Television.

**Objective:** To develop in the individual the capability for removing the chassis from the cabinet and removing and replacing the components without damage to the adjacent parts.

**Manual or Manipulative Learning:**

Communication:

- A. Removing and replacing the back cover screws with a screwdriver.
- B. Removing and replacing the chassis in the cabinet using the appropriate tools.
- C. Removing and replacing the knobs from the front of the television.
- D. Discharging the static charge from the picture tube and high voltage tubes with a screwdriver.
- E. Removing and replacing the defective components from the chassis with a soldering gun and the appropriate tools.
- F. Replacing the defective cord and/or plug.
- G. Soldering the antenna leads in place with a soldering gun.

General Information

- A. Arranging the parts in an orderly procedure to prevent loss or damage.

- B. Recognizing the color code of resistors.
- C. Selecting the proper type and size of screwdrivers, pliers, cutters, nutdrivers.
- D. Applying the proper care, maintenance and storage of tools.
- E. Applying the proper methods of holding the work.
- F. Applying the methods of holding pliers for pulling, pressing and twisting.
- G. Recognizing the results of using pliers for removing nuts and bolts.
- H. Determining the proper methods of stripping wire.
- I. Recognizing the various types of fastening devices.
- J. Recognizing the various types, uses and characteristics of threaded fasteners.
- K. Recognizing the various types and uses of washers.
- L. Applying the proper methods of removing and installing threaded fasteners.
- M. Recognizing the difference between right and left hand threads.
- N. Applying the proper safety precautions:
  - a. wearing safety shoes with non-conducting soles
  - b. removing jewelry and items of clothing containing metal fasteners
  - c. avoiding work situations where moisture is present
  - d. disconnecting the television from the power supply before starting repair operations
  - e. discharging the capacitors of the television
  - f. properly grounding the television
- O. Selecting the proper types, size and tips of soldering irons.
- P. Recognizing the importance of tinning the tip of the soldering iron or soldering gun.
- Q. Recognizing the importance and purposes of flux when soldering.
- R. Applying the proper method of transferring heat to the work.
- S. Selecting the correct solder and flux.
- T. Observing safe working procedures when installing a television chassis.

### Suggested Student Activities

All student activities should be as practical and meaningful as possible. The use of an actual television may assist in this process.

- A. Removing the chassis from the cabinet for ease of servicing.
- B. Unsoldering and resoldering the new components in place.
- C. Reading the schematic to determine the value and location of components.
- D. Determining the correct solder and flux for electrical connections.
- E. Riveting components in position with a riveter.
- F. Connecting the appropriate electrical meters in the proper manner to measure voltage, current and resistance.
- G. Replacing the chassis in the cabinet and reconnecting the built-in antenna with the appropriate tools.

## Unit IV

**Title:** Making the Final Operational Checks and Adjustments to the Television After Repairs have been Completed.

**Objective:** To develop in the individual the capability for making final checks and adjustments to the television.

Manual or Manipulative Learning:

- A. Plugging the television into the service outlet and tuning the set to a local channel.
- B. Adjusting the horizontal and vertical synchronization to eliminate black edges and to center the picture.
- C. Installing an outdoor television antenna and transmission line.

Verbal Learning:Communication:

- A. Interpreting manufacturer's instructions for assembly of the antenna.
- B. Interpreting drawings, specifications, manufacturer's catalogues, service manuals, schematics and handbooks.

Mathematics:

- A. Determining the resonant length of an antenna.

General Information

- A. Recognizing the correct operation of the television from audio and video performance.
- B. Utilizing 300-ohm twin-lead ribbon line wherever possible for connecting the antenna to the receiver.
- C. Recognizing that transmission lines should be as short as possible between the antenna and the receiver.

- D. Selecting the proper type and size of (screwdrivers, pliers, wrenches, cutters, nutdrivers).
- E. Applying the proper care, maintenance and storage of tools.
- F. Recognizing the proper methods of holding wrenches.
- G. Applying the proper methods of holding work.
- H. Applying methods of holding pliers for pulling, pressing and twisting.
- I. Recognizing the results of using pliers for removing nuts and bolts.
- J. Applying the proper procedures for cutting with diagonal cutters.
- K. Determining the proper methods of stripping wire.
- L. Recognizing the various types of fastening devices.
- M. Recognizing the various types, uses and characteristics of threaded fasteners.
- N. Recognizing the various types and uses of washers.
- O. Applying the proper methods of installing threaded fasteners.
- P. Recognizing the difference between right and left hand threads.

#### Suggested Student Activities

All student activities should be made as practical and meaningful as possible. The use of a repaired television may assist in this process.

- A. Making the final adjustments to a repaired television.

**Unit V**

**Title:** Occupational information pertaining to television servicing and Related Occupations.

**Objectives:** To acquaint the individual with the opportunities in television servicing and related occupations.

**Occupational Information**

**Obtaining Information about:**

- a. The employment outlook.
- b. The wage scale.
- c. The types of training available.
- d. The working conditions experienced in the occupation.
- e. The physical and mental characteristics needed for qualification for employment.
- f. The geographical location of employment.
- g. Opportunities for advancement.
- h. The advantages and disadvantages of the occupation.
- i. The nature of the work involved in the occupation.
- j. The union involvement in the occupation.
- k. The means of entry into the occupation.

Suggested Student Activities

- A. Writing specific information concerning opportunities in the occupations of the electro-mechanical cluster.
- B. Visiting an office of the State Employment Service.
- C. Listening to a speaker from a trade union.
- D. Writing letters to correspondence and trade schools in order to determine opportunities for additional training.
- E. Visiting a school for apprentices.
- F. Visiting a television service shop.
- G. Watching movies of electricity and television fundamentals.
- H. Reading the Occupational Outlook Handbook.

## INSTRUCTIONAL MATERIALS FOR RADIO AND TELEVISION SERVICING

TYPE	TITLE	DESCRIPTION	SOURCE
Book	<u>Fundamentals of Radio</u> by M.P. Rosenthal	Comprehensive coverage of basic radio principles and servicing techniques is included in the book.	John F. Rider Publications
Book	<u>Basic Radio Repairs - Volumes I and II</u> by Marvin Tepper	Book covers servicing techniques for radios.	John F. Rider Publications
Book	<u>Radio Trouble-Shooting Guide</u> by J. F. Rider	Fundamentals of trouble shooting radios are covered in the book.	John F. Rider Publications
Book	<u>Basic Television by Bernard Grab</u>	Comprehensive coverage of monochrome and color television is included in the book.	McGraw-Hill Book Co.
Book	<u>Television Servicing</u> by Alex Levy and Murray Frankel	Book covers basic servicing techniques for the beginning service man.	McGraw Hill Book Co.
Book	<u>Profitable Television Troubleshooting</u> by E. A. Anthony	Step by step procedures are shown in the book for servicing television sets.	McGraw-Hill Book Co.
Book	<u>Fundamentals of Television</u> by W. H. Buchbaum	Book provides information about basic television circuits.	John F. Rider Publications

**Book** Television and Radio Repairing by John Marcus

**Book** Provides step by step instructions for testing, repairing, and replacing parts.

**Book** Introduction to Electronic Servicing for The Beginner by J. A. Stanley

**Book** Provides information about troubleshooting home-made and commercial electronic gear.

**Film** Power Unlimited

**Film** Shows how electricity is produced by tiny atoms. 13 min. rental \$1.75.

**Film** Stepping Along With Television

**Film** Demonstrates the operation of television. 10 min. free.

**Film** What is Electricity

**Film** Shows fundamental electrical theory. 20 min. free.

**Film** Alternating Current Strip

**Film** Strip shows inductance, capacitance, and impedance in a circuit. 9 min. purchase price \$4.95.

**Film** Current Electricity Strip

**Film** Strip shows laws of current flow in various types of circuits. 74 min. purchase price \$4.95.

**Film** Static Electricity Strip

**Film** Strip shows the electron theory of positive and negative charges. 73 min. purchase price \$4.95.

**McGraw-Hill Book Co.**

**Book** Provides step by step instructions for testing, repairing, and replacing parts.

**Howard W. Sams & Co.**

**Book** Provides information about troubleshooting home-made and commercial electronic gear.

**Arizona State University Film Cooperative**

**Film** Shows how electricity is produced by tiny atoms. 13 min. rental \$1.75.

**Selected Motion Pictures**

**Westinghouse Corporation**

**Film** Shows fundamental electrical theory. 20 min. free.

**Jan Handy**

**Film** Strip shows inductance, capacitance, and impedance in a circuit. 9 min. purchase price \$4.95.

**Jan Handy**

**Film** Strip shows laws of current flow in various types of circuits. 74 min. purchase price \$4.95.

**Jan Handy**

**Film** Strip shows the electron theory of positive and negative charges. 73 min. purchase price \$4.95.

Chart Wall size chart with 34 X 22 in size, free block diagram of radio receivers. Howard W. Sams & Co.

Chart Wall size chart with 34 X 22 in size, free diagram of typical television and radio receivers. Howard W. Sams & Co.

Chart Wall size chart with 24 X 30 board, prices available on request demonstrations on transistors. General Motors Corp.

Chart Phanphlet You Can Understand The Atom Material explains the atom, free. U. S. Atomic Energy Commission

## **SOURCES FOR INSTRUCTIONAL MATERIALS**

**This section of the report provides the addresses for the instructional materials listed at the end of each occupational area.**

## SOURCES FOR INSTRUCTIONAL MATERIALS

**Arizona State University,  
Film Cooperative  
Tempe, Arizona**

**Encyclopaedia Britannica  
Films, Inc.  
1150 Wilmette Ave.  
Wilmette, Illinois**

**Frederick J. Drake & Co.  
9 S. Clinton St.  
Chicago 6, Illinois**

**General Electric Company  
Distribution Section Advertising  
and Sales Promotion  
1 River Rd.  
Schenectady 5, New York**

**General Motors Company  
Educational Relations Dept.  
Dept. of Public Relations  
Box 177, North End Station  
Detroit 2, Michigan**

**Sam Handy  
281 E. Grand Blvd.  
Detroit 11, Michigan**

**McGraw-Hill Book Co., Inc.  
330 W. 42nd St.  
New York 36, New York**

**National Radio Institute  
3939 Wisconsin Ave.  
Washington, D.C., 20016**

**National Service Department  
Merchandise Mart Plaza  
Chicago 54, Illinois**

**Norwood Films  
926 New Jersey Ave., N.W.  
Washington 1, D.C.**

**John F. Rider Publisher, Inc.  
116 W. 14th St.  
New York 11, New York**

**Howard W. Sams & Co., Inc.  
4300 W. 62nd St.  
Indianapolis, Indiana**

**Selected Motion Pictures  
799 Stevenson St.  
San Francisco 3, California**

**U.S. Atomic Energy Commission  
Washington 25, D.C.**

**Visual Instruction Bureau  
University of Texas  
Austin, Texas**

**Westinghouse Corporation  
School Service  
P.O. Box 1017  
Pittsburgh 30, Pennsylvania**